INSTITUTE OF AGRICULTURAL ECONOMICS, BELGRADE, SERBIA

SUSTAINABLE AGRICULTURE AND RURAL DEVELOPMENT

Thematic Proceeding

Belgrade, 2021

INSTITUTE OF AGRICULTURAL ECONOMICS
BELGRADE

Volgina Street no. 15, 11060 Belgrade, Serbia
Phone/Fax: +381 (0) 11 69 72 858
Phone: +381 (0) 11 69 72 848

E-mail:
office@iep.bg.ac.rs

Internet address:
www.iep.bg.ac.rs

International Scientific Conference

SUSTAINABLE AGRICULTURE AND RURAL DEVELOPMENT

THEMATIC PROCEEDING

February, 2021

Belgrade, Serbia

Publisher:

Institute of Agricultural Economics, Belgrade, Serbia

Editors:

Jonel Subić, Ph.D.

Predrag Vuković, Ph.D.

Jean Vasile Andrei, Ph.D.

Technical arrangement and printing:

SZR NS MALA KNJIGA +

Zetska Street no. 15,

21000 Novi Sad, Republic of Serbia,

Phone: +381 21 64 00 578

Technical preparation and typesetting:

Vladimir Sokolović

Number of copies: **300**

ISBN-978-86-6269-096-8

ISBN (e-book)-978-86-6269-097-5

Publishing of Thematic Proceeding was financially supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

Organizers

1. INSTITUTE OF AGRICULTURAL ECONOMICS, BELGRADE - SERBIA
   Prof. *Jonel Subić*, Ph.D.

Co-organizers

1. NATIONAL TEAM FOR THE REVIVAL OF SERBIAN VILLAGES, BELGRADE - SERBIA
   Milan Krkobabić, B.Sc. and Academician *Dragan Škorić*
2. CHAMBER OF COMMERCE AND INDUSTRY OF SERBIA, BELGRADE - SERBIA
   Marko Čadež, B.Sc.
3. FACULTY OF AGRICULTURE, NOVI SAD - SERBIA
   Prof. *Nedeljko Tica*, Ph.D.
4. FACULTY OF AGRICULTURE, BELGRADE - SERBIA
   Prof. *Dušan Živković*, Ph.D.
5. FACULTY OF ECONOMICS, SUBOTICA - SERBIA
   Prof. *Aleksandar Grubor*, Ph.D.
6. FACULTY OF ECONOMICS, KRAGUJEVAC - SERBIA
   Prof. *Petar Veselinović*, Ph.D.
7. FACULTY OF HOTEL MANAGEMENT AND TOURISM, UNIVERSITY OF KRAGUJEVAC, VRNJAČKA BANJA - SERBIA
   Prof. *Drago Cvijanović*, Ph.D.
8. FACULTY FOR APPLIED ECOLOGY (FUTURA), BELGRADE - SERBIA
   Prof. *Jordan Aleksić*, Ph.D.
9. FACULTY OF APPLIED MANAGEMENT, ECONOMICS AND FINANCE (MEF), BELGRADE - SERBIA
   Prof. *Tomislav Brzaković,* Ph.D.
10. FACULTY OF ECONOMICS AND ENGINEERING MANAGEMENT, UNIVERSITY BUSINESS ACADEMY, NOVI SAD - SERBIA
    Prof. *Dragan Soleša*, Ph.D.
11. FACULTY FOR BIOFARMING, MEGATREND UNIVERSITY, BAČKA TOPOLA - SERBIA
    Prof. *Gorica Cvijanović,* Ph.D.
12. UNIVERSITY "UNION – NIKOLA TESLA", BELGRADE - SERBIA
    Prof. *Nebojša Zakić*, Ph.D.
13. UNIVERSITY EDUCONS, NOVI SAD - SERBIA
    Prof. *Aleksandar Andrejević,* Ph.D.
14. INSTITUTE OF ECONOMIC SCIENCES, BELGRADE - SERBIA
    Jovan Zubović, Ph.D.
15. INSTITUTE FOR SCIENCE APPLICATION IN AGRICULTURE, BELGRADE - SERBIA
    Rade Jovanović, Ph.D.

16. NOVI SAD BUSINESS SCHOOL, NOVI SAD - SERBIA

    Prof. *Jelena Damjanović*, Ph.D.

17. RAPS - DEVELOPMENT ACADEMY OF SERBIAN AGRICULTURE, BELGRADE - SERBIA

    Prof. *Mihailo Ostojić*, Ph.D.

18. BALKAN SCIENTIFIC ASSOCIATION OF AGRICULTURAL ECONOMIST, BELGRADE - SERBIA

    Prof. *Goran Maksimović*, Ph.D.

19. COOPERATIVE UNION OF SERBIA, BELGRADE - SERBIA

    Nikola Mihailović, B.Sc.

20. AGRICULTURAL EXTENSION SERVICES OF BELGRADE, BELGRADE - SERBIA

    Milica Janković, M.Sc.

21. FACULTY OF AGRO-FOOD AND ENVIRONMENTAL ECONOMICS, BUCHAREST UNIVERSITY OF ECONOMIC STUDIES, BUCHAREST - ROMANIA

    Prof. *Mirela Stoian*, Ph.D.

22. FACULTY OF SOCIAL AND CULTURAL SERVICE AND TOURISM, STAVROPOL STATE AGRARIAN UNIVERSITY, STAVROPOL - RUSSIAN FEDERATION

    Prof. *Ivan Ivanovich*, Ph.D.

23. NATIONAL INSTITUTE FOR ECONOMIC RESEARCH “COSTIN C. KIRITESCU”, ROMANIAN ACADEMY, BUCHAREST - ROMANIA

    Prof. *Luminita Chivu*, Ph.D.

24. UNIVERSITY OF AGRONOMIC SCIENCES AND VETERINARY MEDICINE OF BUCHAREST (USAMV), BUCHAREST - ROMANIA

    Prof. *Sorin Mihai Cimpeanu*, Ph.D.

25. RESEARCH CENTRE FOR SUSTAINABLE RURAL DEVELOPMENT OF ROMANIA, ROMANIAN ACADEMY, TIMISOARA - ROMANIA

    Prof. *Vasile Gosa*, Ph.D.

26. FACULTY OF ECONOMICS SCIENCE, PETROLEUM - GAS UNIVERSITY OF PLOIESTI, PLOIESTI - ROMANIA

    Prof. *Irena Gabriela Rapulescu*, Ph.D.

27. FACULTY OF AGRICULTURE, UNIVERSITY OF BANJA LUKA - BOSNIA AND HERZEGOVINA

    Prof. *Zlatan Kovačević*, Ph.D.

28. UNIVERSITY OF CATANIA - ITALY

    Prof. *Loredana Cardullo*, Ph.D.

29. LEIBNIZ INSTITUTE OF AGRICULTURAL DEVELOPMENT IN TRANSITION ECONOMIES (IAMO), HALLE – GERMANY

    Prof. *Thomas Glauben*, Ph.D.

30. INSTITUTE OF AGRICULTURAL ECONOMICS, SOFIA - BULGARIA

    Prof. *Božidar Ivanov*, Ph.D.

31. NATIONAL INSTITUTE FOR ECONOMIC RESEARCH, CHISINAU - MOLDOVA
    Prof. *Alexandru Stratan*, Ph.D.
32. INSTITUTE OF AGRICULTURAL ECONOMICS, BUCHAREST - ROMANIA
    Cecilia Alexandri, Ph.D.
33. INSTITUTE FOR AGRICULTURE ECONOMICS AND RURAL DEVELOPMENT (ICEADR), BUCHAREST - ROMANIA
    Ana Ursu, Ph.D.
34. BALKAN ENVIRONMENTAL ASSOCIATION (B.EN.A.), THESSALONIKI - GREECE
    Mariana Golumbeanu, Ph.D.
35. RESEARCH NETWORK ON RESOURCES ECONOMICS AND BIOECONOMY (RebResNet), PLOIESTI - ROMANIA
    Prof. *Andrei Jean Vasile,* Ph.D.
36. UNIVERSITY OF BIJELJINA, BIJELJINA - BOSNIA AND HERZEGOVINA
    Prof. *Milena Jelikić Stankov*, Ph.D.

HONORARY BOARD

- *Branko Ružić,* M.A., Minister of Education, Science and Technological Development of the Republic of Serbia, Belgrade - Serbia.
- *Branislav Nedimović,* B.Sc., Minister of Agriculture, Forestry and Water Management of the Republic of Serbia, Belgrade - Serbia.
- *Milan Krkobabić,* B.Sc., Minister of Rural Welfare, Co-president of the National Team for the Survival of Serbian Villages, Belgrade - Serbia.
- Academician *Dragan Škorić,* President of the Academic Committee for the Village of the Serbian Academy of Sciences and Arts, Co-president of the National Team for the Revival of Serbian Villages, Belgrade - Serbia.
- Prof. *Ivan Atanov,* Ph.D., Rector of the Stavropol State Agrarian University, Stavropol - Russian Federation.
- Prof. *Nicolae Istudor*, Ph.D., Rector of the Bucharest University of Economic Studies, Bucharest – Romania.
- *Marko Čadež,* B.Sc., President of the Chamber of Commerce and Industry of Serbia, Belgrade – Serbia.
- *Mirjana Dukić Mijatović,* Ph.D. State Secretary of the Ministry of Education, Science and Technological Development of the Republic of Serbia, Belgrade – Serbia.
- *Marina Soković,* Ph.D. Assistant Minister in the Ministry of Education, Science and Technological Development of the Republic of Serbia, Belgrade – Serbia.
- *Saša Lazović,* Ph.D., Assistant Minister in the Ministry of Education, Science and Technological Development of the Republic of Serbia, Belgrade – Serbia.
- *Aleksandar Bogićević,* B.Sc., Assistant Minister in the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia, Belgrade – Serbia.
- *Nenad Katanić*, Ph.D., Assistant Minister in the Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia, Belgrade – Serbia.

- Prof. *Snežana Bogosavljević Bošković*, Ph.D., Faculty of Agronomy, Čačak – Serbia.
- Prof. *Nedeljko Tica*, Ph.D., Dean of the Faculty of Agriculture, Novi Sad – Serbia.
- Prof. *Dušan Živković*, Ph.D., Dean of the Faculty of Agriculture, Belgrade – Serbia.
- Prof. *Petar Veselinović*, Ph.D., Dean of the Faculty of Economics, Kragujevac – Serbia.
- Prof. *Aleksandar Grubor*, Ph.D., Dean of the Faculty of Economics, Subotica – Serbia.
- Prof. *Zorica Vasiljević*, Ph.D., Faculty of Agriculture, Belgrade – Serbia.
- Prof. *Aleksandar Rodić*, Ph.D., Head of Robotics Department, Institute „Mihailo Pupin“, Belgrade - Serbia
- Prof. *Igor Tomašević*, Ph.D., Faculty of Agriculture, Belgrade – Serbia
- Prof. *Drago Cvijanović*, Ph.D., Dean of the Faculty of Hotel Management and Tourism, University of Kragujevac, Vrnjačka Banja – Serbia
- Prof. *Aleksandar Andrejević*, Ph.D., Rector of the University „EDUCONS“, Novi Sad – Serbia.
- Prof. *Jordan Aleksić*, Ph.D., President of the Council of the Faculty „FUTURA“, Belgrade – Serbia.
- Prof. *Gorica Cvijanović*, Ph.D., Dean of the Faculty for Biofarming, Megatrend University, Bačka Topola – Serbia.
- Prof. *Koviljko Lovre*, Ph.D., President of Serbian Association of Agricultural Economists, Belgrade – Serbia.
- Prof. *Marko Carić*, Ph.D., Rector of the University Business Academy, Novi Sad – Serbia.
- Prof. *Tomislav Brzaković*, Ph.D., Dean of the Faculty of Applied Management, Economics and Finance, Belgrade – Serbia.
- Prof. *Nebojša Zakić*, Ph.D. Rector of the University „Union – Nikola Tesla“, Belgrade, Serbia.
- Doc. *Nikola Milićević*, Ph.D., Faculty of Economics, Subotica – Serbia.
- *Jovan Zubović*, Ph.D., Director of the Institute of Economic Sciences, Belgrade – Serbia.
- *Rade Jovanović*, Ph.D., Director of the Institute for Appliance of Science in Agriculture, Belgrade – Serbia.
- *Ljubinko Rakonjac*, Ph.D., Director of the Institute of Forestry, Belgrade – Serbia.
- *Milan Lukić,* Ph.D., Director of the Institute "Dr Josif Pančić", Belgrade – Serbia.
- Prof. *Mihailo Ostojić*, Ph.D., President of the Council of Development academy of Serbian Agriculture (RAPS), Belgrade – Serbia.
- *Mariana Golumbeanu*, Ph.D., Vice president of the Balkan Environmental Association (B.EN.A.), Thessaloniki – Greece.
- Prof. *Vasile Gosa*, Ph.D., Director of the Research Centre for Sustainable Rural Development of Romania, Romanian Academy, Timisoara – Romania.
- Prof. *Andrei Jean Vasile*, Ph.D., President of the Research Network on Resources Economics and Bioeconomy (RebResNet), Ploiesti – Romania.
- Prof. *Thomas Glauben*, Ph.D., Director of the Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Halle – Germany.
- Prof. *Luminita Chivu*, Ph.D., Director of the National Institute for Economic Research "Costin C. Kiritescu", Romanian Academy, Bucharest – Romania.

ORGANIZATIONAL BOARD

Table of Contents

PLENARY SECTION

THEMATIC PROCEEDING

PREFACE

The Thematic Proceeding is prepared as the result of the scientific research supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

The Thematic Proceeding includes selected paper works presented at the International Scientific Conference – Sustainable agriculture and rural development which was held in Belgrade on December 17th and 18th 2020.

In the Thematic Proceeding are included the paper works from Serbia, along with the invited and other articles from abroad, prepared by foreign authors, which are IAE, Belgrade associates whose institutions and organizations have close scientific, professional and technical cooperation with the IAE, Belgrade.

The Thematic Proceeding addresses the wider audience by being scientifically and practically focused on all segments of sustainable agriculture and rural development.

Publisher and editors are not responsible for the content of the scientific papers and opinions published in the Thematic Proceeding, as they represent the author's point of view.

Publishing of the Thematic Proceeding was financially supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

In Belgrade,
February, 2021

Editors:
Jonel Subić, Ph.D.
Predrag Vuković Ph.D.
Jean Vasile Andrei, Ph.D.

PLENARY SECTION

INNOVATIONS IN THE AGRO-INDUSTRIAL COMPLEX AS A FACTOR IN ENSURING THE RUSSIAN FOOD SECURITY

Anna Ivolga[1], Irina Shakhramanian[2]

Abstract

The paper considers the prospects for sustainable development of the agro-industrial complex, which ensures the country's food security and access to world food markets by the latest scientific achievements. The authors prove that the achievement of technological independence in the agricultural sector and the development of new technologies is an urgent task facing the country. In accordance with this, a set of measures aimed at solving this large-scale task is proposed.

Key words: *agribusiness, agro-industrial complex, innovation, food security, food and processing industry.*

Introduction

The doctrine of food security in Russia still remains the main reference point in the state's economic policy, which is aimed at providing the country's population with reliable food products, developing domestic agro-industrial and fisheries complexes, and ensuring reliable import substitution in these areas. In his address to the Federal Assembly in 2015, President of the Russian Federation Vladimir Putin set the goal of fully providing the domestic market with domestic food by 2020.

Methods of the research

The theoretical and methodological basis is the modern economy, scientific works of domestic and foreign scientists in the field of food security of the country. The research was based on abstract-logical, computational and comparative methods with the use of analysis of official statistic information. The information and empirical background is the data from the annual statistical reports of the Federal State Statistic Service and data of monitoring of the food sector at various levels.

1 Anna Ivolga, Ph.D. in Economics, Associate Professor, Stavropol State Agrarian University, Zootekhnichesky Side-Street no. 12, 355017 Stavropol, Russian Federation, Phone: +892 800 535 42, E-mail: annya_iv@mail.ru

2 Shakhramanian Irina, M.A., Assistant, Stavropol State Agrarian University, Zootekhnichesky Side-Street no. 12, 355017 Stavropol, Russian Federation, Phone: +896 14 766 471, E-mail: boomblow@mail.ru

Discussion and Results

The current state of the country's food security and measures to strengthen it considered in many works of scientists, researchers and practitioners.

Analysis of these publications leads to the following conclusion: to achieve a sufficient level of food security, it is necessary to solve a number of serious problems, including the following:

1) agricultural producers remain highly indebted, with low availability of credit resources and high interest rates (especially on investment loans) [3];
2) prices for material and technical resources continue to rise, primarily for mineral fertilizers and fuel and lubricants purchased by agricultural producers;
3) there is a low availability of equipment and a high level of depreciation of fixed assets in agriculture and the food industry;
4) transport, engineering and social infrastructure in rural areas remains underdeveloped;
5) the level of wages in agriculture is noticeably lower than in urban areas;
6) the Russian agro-industrial complex remains significantly dependent on imports of machinery and equipment, breeding, planting material and seeds [7];
7) the presence of counterfeit and contraband products on the food market is noted.

It should be noted that Russia, having unprecedented competitive advantages in acreage, fresh water reserves, energy and labor resources, has been demonstrating high results in harvesting in recent years and is confidently among the key suppliers of agricultural products on the world food market [7]. According to Federal State Statistics Service of Russia, the volume of exports of food products and agricultural raw materials (except textiles) amounted to 16.2 billion US dollars in 2017 and 17.0 billion US dollars in 2018 [5].

These successes are not accidental. They contributed to the effective economic and organizational measures of the state support (table 1) [6], the implementation of state programs on agriculture development, successfully used sanctions and embargoes on imports (table 2) [5], prompting the agriculture Ministry order in the sector and fairly favorable weather conditions in recent years.

Table 1. Indicators of implementation of the Federal law «on financial rehabilitation of agricultural producers» (as of 2018).

Indicators	Total for Russia
Number of organizations participating in the financial recovery program, units	13 289
The amount of restructured debt by the organizations signatory to the agreement on the restructuring of debt, thousand rubles	88 522 316
Amount of written-off debt on penalties and fines, thousand rubles	33 660 639
Number of organizations that have completed the restructuring due to the fulfillment of the terms of the restructuring, units	2773
The amount of the repaid debt, thousand rubles	3 789 880

Source**:** The table based on data from the Ministry of agriculture of the Russian Federation.

We can also agree with the opinion that the state of the domestic agro-industrial complex now determined by consistently high agricultural production, especially export-oriented grain production, which exceeds the domestic needs of the country.

Table 2. Production of the main types of import-substituting food products in the Russian Federation (thousand tons).

Products	2015	2016	2017	2018	
				January-October	As a percentage of the corresponding period in 2017
Meat of bovine animals	240,6	224,1	254,7	211,6	103,0
Pork	1299,5	1525,7	1763,0	1619,5	113,3
Meat and offal of poultry	3610,0	3979,0	4340,0	3683,0	103,1
Frozen fruit and vegetable products	45,0	46,0	55,4	52,0	111,7
Whole milk products (in terms of milk), million tons	11,5	11,5	11,7	9,9	101,7
Cheeses and cheese products	435,0	499,0	589,0	502,0	101,9

Source**:** The table based on data from the Federal State Statistics Service of Russia.

At the same time, it becomes obvious that the country's food security is not only providing the population with food as such, but also providing agricultural producers with domestic seeds, seedlings, breeding material, agricultural machinery and equipment. For example, our dependence on imported brands for seeds, especially beets, and vegetables almost reaches 70 %. Moreover, as a rule, seeds of F1 hybrids that are not subject to reproduction supplied from abroad [2].

As a result, Russian farmers forced to purchase new batches of seeds and the necessary mechanization and chemical kits for their use every year.

Of course, the growth in the production of meat and dairy products is a positive thing, but if there, still a dependence on seeds, then there can be no question of food security. Therefore, it is necessary to pay great attention to solving these issues, in particular, to create breeding, genetic, and seed breeding centers, modern storage facilities for primary products, wholesale and distribution centers for agricultural products, and to promote technical re-equipment of the industry.

The implementation of the Federal scientific and technical program for agricultural development for 2017-2025 will help overcome the technological dependence of domestic agricultural production and improve the quality of seeds and planting material [1]. The development of this program provided for by decree of the President of the Russian Federation No. 350 of July 21, 2016 «On measures to implement the state scientific and technical policy in the interests of agricultural development».

In General, it becomes obvious that in our time, the implementation of the prospects for sustainable development of the agro-industrial complex, which ensures the country's food security and access to world food markets, is possible only with the use of the latest scientific achievements. This is how the issue raised in Decree of the President of the Russian Federation No. 350 of July 21, 2016 «On measures to implement the state scientific and technical policy in the interests of agricultural development».

In recent decades, the agro-industrial complex has turned into a high-tech sphere. The agricultural industry is in demand for the achievements of mechanical engineering and robotics, IT technologies, chemistry, space, nuclear technologies, nanotechnologies and the latest biotechnologies. Simultaneously with the solution of the priority task of domestic science to ensure the technological independence of the country, scientific and technical innovations should also come to the agro-industry. Overcoming the backlog in the development and use of the latest technologies by the domestic agricultural sector is a real key to effective Russian agricultural production and obtaining safe food products [4].

It is obvious that without serious scientific efforts and without combining the potential of the scientific community, representatives of higher education and representatives of the real sector of the economy, we will not be able to achieve serious results in scientific support for the development of the agro-industrial complex and the system of safe and healthy nutrition.

The main task is to ensure a continuous chain from the fundamental idea to the finished product that meets all the most serious standards and requirements for food safety and quality.

For this purpose, Federal research centers created to provide a full range of priority fundamental research, including research on an interdisciplinary basis, combining the actual potential of biologists, geneticists, cytologists, chemists, mathematicians, engineers, and so on.

Another serious threat to Russia's food security is the high dependence of domestic processing enterprises on imported foreign equipment. Over the past decades, we have almost lost the production base of mechanical engineering for the processing industry. To restore it in the shortest possible time, it is possible to seek assistance from the enterprises of the military-industrial complex, given the upcoming diversification in the coming years. It is also necessary to strive to create joint ventures with foreign partners (for example, the automotive industry).

Non-agricultural technical universities can and should contribute to solving this problem.

Of course, the innovative development of the agro-industrial complex will require serious funding. Therefore, it is not necessary to rely only on budget opportunities. Here the farmers themselves should have their say. The government of the Russian Federation needs to create incentives and motivate large agro-industrial businesses to invest in research, RD, new technologies, in short, in innovations. The volume of investment in science by the agricultural business and not only (huge opportunities in this sense for producers of mineral fertilizers) should be measured in tens of billions of rubles a year, and then science will be in demand. The mechanism of public-private partnership should be widely used for this purpose. We believe that intangible assets and innovative products should account for at least 30-50% of the total market value of agricultural corporations. Only in this case can we count on their long-term competitiveness.

Conclusion

Thus, it becomes obvious that in order to ensure the country's food security, it is necessary to make a number of decisions, including those aimed at improving the effectiveness of state support and regulation in the agro-industrial complex, improving their mechanisms, and creating conditions for the modernization of food and processing enterprises through technical re-equipment based on innovative resource-saving technologies. It is important to develop domestic food aid in the Russian Federation both to improve the nutrition of certain categories of citizens in need of social support and to achieve its balance, taking into account rational norms of food consumption, and to stimulate domestic demand for domestic agricultural raw materials and food.

In conclusion, we can conclude that the current task facing the country is to achieve technological independence in the field of agriculture, the development of new technologies (the 6th technological order). The solution of this large-scale task requires a comprehensive approach, including measures such as:

1) development and application of the latest biotechnologies, including genomic and cellular engineering;
2) organization of precision farming systems, work with unmanned and space equipment;
3) advanced development of mechanical engineering and robotics for agriculture and food industry;
4) widespread use of IT technologies and approaches to radically improve the quality of land cultivation and territorial specialization of agricultural production;
5) implementation of effective cooperation with non-agricultural research organizations and universities.

Literature

1. Analytical center under the Government of the Russian Federation (2020): *Dynamics and structure of Russia's GDP,* Moscow, 14 p.
2. Analytical center under the Government of the Russian Federation (2018): *Russian agricultural markets*, Moscow, 94 p.
3. Erokhin V. L. (2011): *Specifics of development of agrarian business in the conditions of trade and economic integration,* Bulletin of agrarian and industrial complex Stavropol, № 1 (1), pp. 69a-72.

4. Lisova O. M., Elfimova Y. M., Radishauskas T. A. (2017): *Management of sustainable development of enterprises: ecological and economic aspect,* The scientific journal of the Kuban state agrarian university, № 09 (133), pp. 30-39.
5. Publications of the Federal state statistics service (2018): *Statistical publication,* Moscow.
6. Publications of the Ministry of agriculture of the Russian Federation (2018): *Overview of agricultural markets,* Moscow.
7. Riazantsev I. I. (2019): *Land relations in the agricultural efficiency management system,* Monograph, Stavropol, p. 320.

PRECISION AGRICULTURE: KEY CONCEPTS

Ancuța Marin[1], *Steliana Rodino*[2]

Abstract

The sustainable use of natural resources by employing technical and social modernization of agriculture, is a constant preoccupation, given current challenges related to climate changes, maintenance of competitiveness for agricultural producers and the decrease of dependence to non-renewable resources. In a situation where the world population is constantly growing and the agricultural fund is limited and with clear trends of deterioration, agricultural research has played a particularly important role in increasing production and in the most rational exploitation of existing resources.

The concept of precision agriculture involves regulating the inputs to the agricultural system (seeds, fertilizers, pesticides) so that they are distributed in precise location, quantity, and time needed. Measuring the various working parameters through sensors and transducers, analyzing the information received through computer systems and specific software, and sending commands to change other parameters on tractors and agricultural machines created the Smart farming system.

Key words: *agriculture development, technological innovation, precision farming.*

Introduction

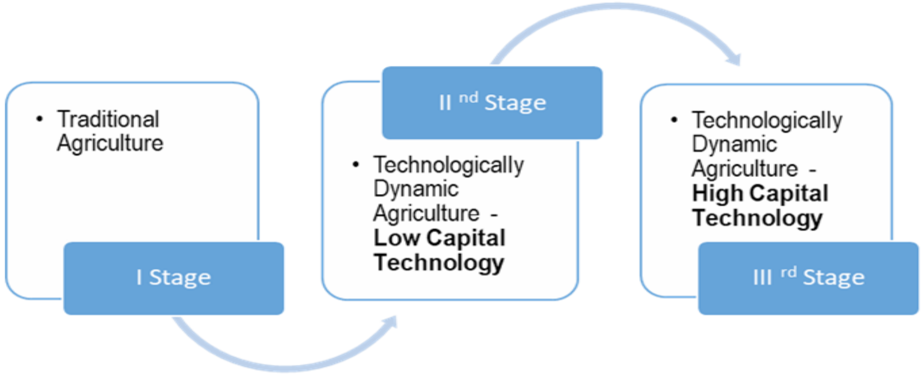
Agriculture is representing one of the most important economic sector, providing food security, jobs and source of income for rural inhabitants. A topical issue nowadays is the provision of food for an incresing world population. The sustainable use of natural resources by employing technical and social modernization of agriculture, is a constant preocupation, given curent challenges related to climate changes, maintainance of competitivity for agricultural producers and the decrease of dependence to non-renewable resources.

1 Ancuța Marin, Ph.D., Senior Researcher, Institute of Research for Agriculture Economy and Rural Development, Bd. Marasti no. 61, District 1, 011464 Bucharest, Romania, Phone: +074 209 00 21, E-mail: ancuta.marin@iceadr.ro

2 Steliana Rodino, Ph.D., Principle Research Fellow, Institute of Research for Agriculture Economy and Rural Development, Bd. Marasti no. 61, District 1, 011464 Bucharest, Romania, Phone: +074 209 00 21, E-mail: steliana.rodino@yahoo.com

From a historical point of view, the influence of industry on agriculture is undeniable. In early 80'sMellor and Johnston were inspired by the Rostownian stages of economic development when they established the three major historical stages in the evolution of agriculture.

Figure 1. The three stages of agriculture development



Source: authors own representation, adapted from Mellor

The first stage is that of the preconditions for agricultural development. During it, there are institutional and behavioral changes that are essential for increasing output: improving the land structure, access to the consumer goods market, information on available techniques, changing behaviors and expanding farmers' receptivity to progress.

The second stage is characterised by an increase in the efficiency of agricultural production processes by the use of labor intensive technologies with high marginal productivity and capital saving innovations. According to Mellor, only when agriculture moves into this phase from the traditional phase that it can provide resources to the non- farm sector to grow This is the form adopted by agricultural development when the agricultural sector is the dominant productive activity, when the demand for agricultural products increases with population and per capita income and when the capital needed to expand the industrial sector is difficult to find.

The third phase of agricultural evolution is the opposite of the seconf stage. It is characterized by a capital intensive and labor saving technology. It can be seen as the industrialization of agriculture, becouse hhigh level of investment in machinery in agriculture become the main development trigger. This third phase is one in which the relative weight of agricultural production and labor use in the economy is declining rapidly.

Currently, agricultural systems are moving towards regulating the inputs to the agricultural system (seeds, fertilizers, pesticides) so that it is distributed where it is needed exactly how much is needed when needed. Precision agriculture is a concept that was born in the United States in the 1980s. The use of fertilizers, plant protection products and water is increasing sharply and it is becoming important to optimize its use in order to protect humans and the environment. The present paper is an overview of the concept of precision agriculture highlighting advatanges and disadvantages, and summarising the most used and ueful technologies applied.

Precision farming related to crop growth cycles

Precision agriculture is defined as a type of intelligent agriculture that involves the introduction of high-performance technologies and equipment to streamline the agricultural process and ensure production control.

The role of precision agriculture is to provide accuracy to agricultural processes for the best results, helping farmers to efficiently manage their resources, use technology to make their work easier, but also to obtain real-time information about their crops, to make immediate adjustments and optimizations in the production process. The agricultral yield is affected by many variables such as: the type of soil and the topography, the previous ones, the pests present, the irrigation, the date and the density of sowing.

To improve the sector eficiency, precision agriculture is based on:

- plot and intra-plot management;
- optimization of yields and production costs;
- better consideration of the pedoclimatic context (nature of the soil and weather) as well as the vegetation.

Wthout seeking completness, we describe below several technologies and methods used in recision farming, such as, fertilization, pest control, weed control, remote sensing technologies, soil analysis, irigation systems.

Soil analysis systems

The three natural assets that are primarlyy supporting human life, and implicitly the agricultural production are soil, waer and air. Permanent monitorisation of soil composition, umidity and quality leads to increase in agricultural productivity.

The soil analysis systems include soil samplers, tensiometers and soil moisture sensors, devices for monitoring soil erosion or penetrometers, devices that measure the level of soil compaction. The analysis systems provide important data on the condition of the soils, so that farmers can take the proper decision regarding to the suitable crops for specific plots. The purpose is to identify differences on soil characteristics and the yield that can be obtained in different areas of a field and react according to requirements. Therefore, Precision farming begins with identifying the variability of the soil conditions. Adjustment of working depth for plowing, sowing rate and fertilizer spread and can then be adapted according to the information from field sensors or soil mapping. Following on site measurements, off line analysis can be done, such as: soil nutrient maps based on soil analysis and soil mapping by measuring conductivity.

Crop management

Precision agriculture prectices ensure the right amount of plant nutrients, at the right time, proper management of weeds, pests and diseases and sustainable management of water resources.

Precision farming starts with optimal plant nutrition. Above all, precision agriculture is a cleverly practiced agriculture, and this process of simplification also includes fertilization. Through fertilization, plants receive the nutrients necessary for their development. In general, fertilization is done by spreading fertilizers on the cultivated area, but this rule can be applied only in the case of gardens or small areas. For large areas, fertilization equipment streamlines this process, ensuring the penetration of fertilizers exactly in the areas where it is needed, thus amplifying their effect. There are machines equipped with variable application fertilization technology. The process is very efficient: first soil samples are taken to identify the needs of the soil, and then, with the help of commands received by GPS, the machine distributes quantities and types of fertilizer depending on the treated area.

Precision agriculture is supporting farmers towards controlling crop pests through the controlled application of insecticides, fungicides and treatments in exactly the affected area.Continuous crop analysis and monitoring helps farmers know exactly when it is time to act. Machines controlled by GPS systems can distribute different amounts of pesticides depending on the needs of the crops, after the entire area is scanned and the affected parts are determined. Accuracy in pest and weed control helps farmers save significant resources (time, fuel, pesticides), but also better protect crops.

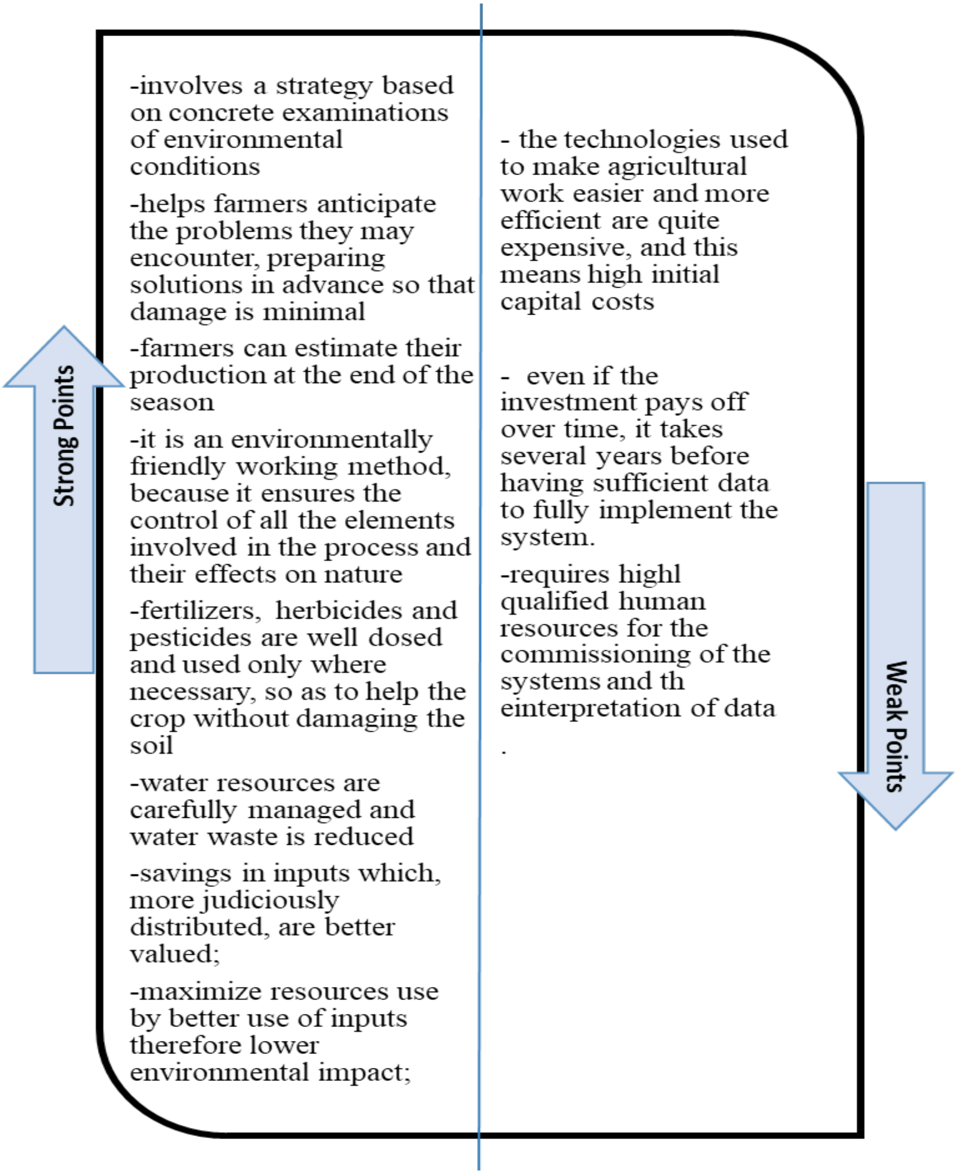
Water is one of the most important resources, and its efficient management, given that huge quantities are consumed in agricultural practices, is a significant gain for the environment. Precision irrigation technology allows farmers to monitor soil moisture, plan crop spraying according to weather conditions, but also use variable rate and control equipment so as to distribute water according to the needs of different parts of the agricultural area. In addition, the advantage is also this time that the irrigation system can be operated via GPS directly from the smartphone. Another technique of precision agriculture is drip irrigation. This method is recommended primarily for vegetable crops and involves dripping a small amount of water exactly at the base of the plant. In this way, the water reaches the right place, without the risk of entering the depth of the soil, where it no longer has an effect on crops.

Harvesting

From ploughing to harvesting, precision agriculture is an added value at every stage of the crop growth cycle. For example, if cereals mature at the same time on all plots of a large-size farm, this can be a problem. The harvest periods can be planned to extend these periods by staggering maturity dates. With a selection of varieties and plots (heterogeneous distribution of early and late varieties on dry and wet plots) and different sowing periods depending on weather conditions, harvest windows can be enlarged. Moreover, at harvest time, differences in quality within the plot can be detected by an analysis of its vegetation using satellite images.

Implementation of disruptive technologies comes with its own advantages and disadvantages (Figure 2).

Figure 2. Benefits and limitations of using precision agriculture



Source: authors own presentation

Precision agriculture technologies help farmers to better manage their crops, to take advantage of the soil potential, but also to protect their crops from pollutants and pests. Agricultural management becomes efficient, because field measurements and analysis of environmental factors (weather, quality and soil properties, seasonality, stage of plant development) provide farmers with the resources to optimally manage their crop.

However, the considerable costs of precision technology hinder its practical application in small size farms. An adapted European subsidy scheme encouraging the generalization of precision agriculture could bring technology closer to all farmers.

Conclusions

Precision agriculture uses observational means (satellites, drones, connected sensors) combined with decision-making tools (accessible in the form of web and mobile applications) in order to collect as much data as possible. This data has a strong environmental impact because they allow intervening only when necessary. For example, the use of plant protection products can be adapted to the strict needs of crops, and plots can be treated by the square meter. The principle of precision farming is to increase the yields of a plot while reducing the consumption of energy and inputs. For this, precision agriculture operates through the use of new technologies, so the idea is to produce more with less.

Precision agriculture will ease the transition towards agroecology, paving the way from conventional agricultural model to a sustainable agricultural model.

Literature

1. Bíró Boróka Júlia, (2015): *Locul Şi Rolul Fermelor Mici În Ruralul Românesc Şi Evoluția Acestora Sub Impactul Politicii Agricole Comune*, Ed Ase, 2015).
2. Butu Marian, Rodino Steliana, Petrache Petruta, Butu Alina, (2017): *Applications of Remote Sensing Techniques for Research on Bioeconomy Field*, Proceedings of: 17th International Multidisciplinary Scientific Geoconference (SGEM), Informatics, Geoinformatics And Remote Sensing, Photogrammetry And Remote Sensing, Cartography and GIS, 17(23), 33-40.
3. Constantin Marinică, (2008): *Teza de doctorat "Dinamica principalelor însușiri ale solului în diferite condiții de producție agricolă*" USAMV, București, 2008.
4. Dumitru Mihail, (2000): *Cod de bune practici*, Editura Vox 2000
5. Kostov Philip, Lingard John, (2002): *Subsistence farming in transitional economies: lessons from Bulgaria*, Journal of Rural Studies, Volume 18 (1), 83-94.

6. Marin Ancuța, Rodino Steliana, Berevoianu Rozi, Chetroiu Rodica, Iurchevici Lidia, (2019): Studiu ”S*isteme de agricultură din Romania” – cercetare internă ICEADR,*
7. Mellor J. W, (2017): *Agricultural Development and Economic Transformation.* doi:10.1007/978-3-319-65259-7
8. Popescu Doris-Louise, (2014): *Subsistence / Semi-subsistence Agricultural Exploitations: Their Roles and Dynamics within Rural Economy/Rural Sustainable Development in Romania*, Procedia Economics and Finance, Volume 16, 563-567.
9. Rodino Steliana, Bușu Alina, Bușu Marian, (2016): *Overview on organic agriculture of Romania in the context of the current European development model*, Proceedings of International Symposium Agrarian economy and rural development - realities and perspectives for Romania, The 7th Edition, 104-111.

Internet sources:

10. https://www.gazetadeagricultura.info/plante/608-agrotehnica/396-sisteme-de-agricultura.html
11. https://www.icpa.ro/documente/coduri/cbpaRO.pdf
12. https://www.agro.basf.ro/ro/stiri/fermier-in-romania/agricultura-de-precizie-ce-este-cum-ajuta-fermierii.html
13. http://www.europarl.europa.eu/studies

POVERTY AND REGIONAL AND RURAL DEVELOPMENT DISPARITIES IN ROMANIA

Cosmin Sălăşan[1], Păun Ion Otiman[2], Vasile Goșa[3], Nicoleta Mateoc Sîrb[4], Adrian Băneş[5], Andreea Feher[6], Miroslav Raicov[7]

Abstract

The evolution of the living standard in Romania has been affected by numerous factors along the past three decades, from the transition to the market economy and the EU pre-accession periods to the EU integration during two programming periods. The poverty rates, the severe material deprivation, along with poverty and exclusion risks are still oscillating within the frame of an unconsolidated regional development growth. The developments over the past twelve years have, to a certain extent, alleviated the situation of the most vulnerable rural households, yet the regional disparities indicate insufficient inner convergence efforts for a balanced territorial development. Further territorial cohesion programming is required to reduce the discrepancies and the targeted development with particular accent for the socially vulnerable categories.

Key words: *poverty, agriculture, regional disparities, development gaps.*

1 Cosmin Sălăşan, Ph.D., Associate Professor, Scientific Researcher II, Research Centre for Sustainable Rural Development of Romania, Romanian Academy, Branch of Timișoara, Bv. Mihai Viteazu no. 24, RO-300223 Timișoara, Romania, Phone: +40 256 491 816, E-mail: cosminsalasan@gmail.com

2 Păun Ion Otiman, Ph.D., Academician, Research Centre for Sustainable Rural Development of Romania, Romanian Academy, Branch of Timișoara, Bv. Mihai Viteazu no. 24, RO-300223 Timișoara, Romania, Phone: +40 256 491 816, E-mail: otiman@acad.ro

3 Vasile Goșa, Ph.D., Full Professor, Scientific Researcher I, Research Centre for Sustainable Rural Development of Romania, Romanian Academy, Branch of Timișoara, Bv. Mihai Viteazu no. 24, RO-300223 Timișoara, Romania, Phone: +40 256 491 816, E-mail: gosavasile@gmail.com

4 Nicoleta Mateoc Sîrb, Ph.D., Full Professor, Scientific Researcher I, Research Centre for Sustainable Rural Development of Romania, Romanian Academy, Branch of Timișoara, Bv. Mihai Viteazu no. 24, RO-300223 Timișoara, Romania, Phone: +40 256 491 816, E-mail: mateocnicol@yahoo.com

5 Adrian Băneş, Ph.D., Full Professor, Scientific Researcher I, Research Centre for Sustainable Rural Development of Romania, Romanian Academy, Branch of Timișoara, Bv. Mihai Viteazu no. 24, RO-300223 Timișoara, Romania, Phone: +40 256 491 816, E-mail: abanes@gmail.com

6 Andrea Feher, Ph.D, Lecturer, Scientific Researcher III, Research Centre for Sustainable Rural Development of Romania, Romanian Academy, Branch of Timișoara, Bv. Mihai Viteazu no. 24, RO-300223 Timișoara, Romania, Phone: +40 256 491 816, E-mail: feherandrea.usab@gmail.com

7 Miroslav Raicov, Ph.D., Assistant, Scientific Researcher III, Research Centre for Sustainable Rural Development of Romania, Romanian Academy, Branch of Timișoara, Bv. Mihai Viteazu no. 24, RO-300223 Timișoara, Romania, Phone: +40 256 491 816, E-mail: mikiraicov@gmail.com

Introduction

The analysis focuses on the poverty as impact of the unbalanced development at regional level in Romania. The findings and observations on the poverty rate and the social exclusion risks as well as the relative poverty and the severe deprivation rates are cross analysed with the levels of income and expenditure at the same scale and filtered by labour resources, active and occupied population. The input data is captured and presented in dynamic for time periods that cover at least the two programming periods of the European Union and where relevant over the past three decades, such as in the case of income and expenditure. As the data indicates, the highest rates and values for poverty and the lesser income and expenditure are recorded for the rural area and particularly for agriculture dependent households. The screening of the relative regional averages takes into account the input of the hired work in all activity sectors, the metropolitan growth centres and urban areas, biasing the county and further the regional averages. For this reason, the income and expenditure dynamics are analysed for farming households aside in order to isolate the source and measure the regional discrepancies. Furthermore, in order to preserve the integrity of the datasets the Bucharest-Ilfov (BI) region is preserved although is heavily tempering the average at regional level. The BI region generates almost 1/3 of the national GDP concentrating over 15% of the national population and with a low specific input and profile for the agricultural production and rural profile. Where relevant the data is subsequently analysed excluding the aforementioned region in order to maintain the comparison bases and operate with a consolidated and representative average.

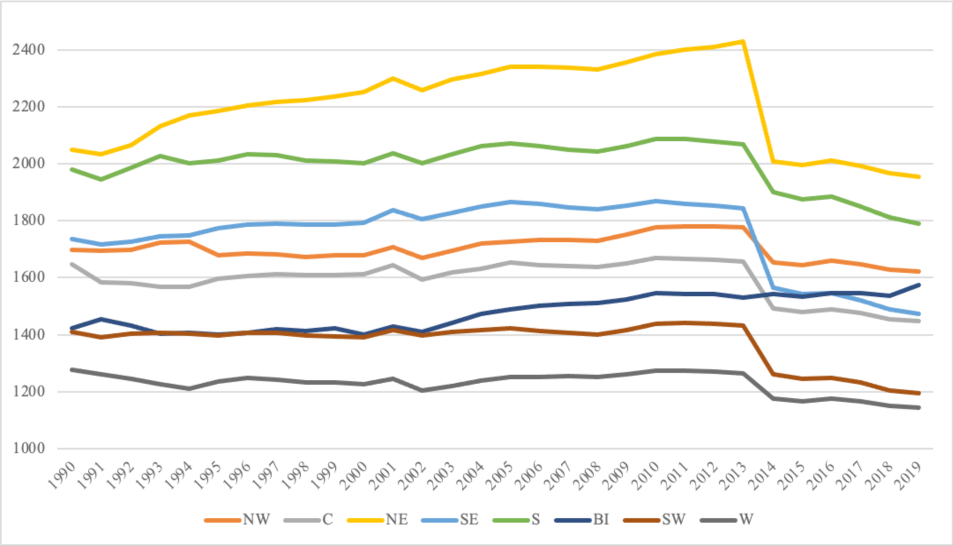
Materials and methods

The paper employs the synchronic approach for the analysis based on secondary sources and official statistics, using alternatively the past thirty years, where relevant, and the last twelve years from the Romania's EU accession as milestone.

Results and discussion

The labour resources at regional level analysed over a thirty years period indicate a synchronous dynamic except for the BI region that benefits from a constant input from all the other regions. The highest variations over time are recorded in the Northeast region (NE) where the over 20% increase of the first 25 years is dropped over the last 5 years of the analysed period (Figure 1). The less pronounced dynamics from the other regions follow the same trend and evolution with the same notable drop in 2014 that although not noticed as phenomena throughout most indicators could be explained by an accelerated migration. The internal migration, except towards the BI region, is tempered by the external migration the inland loss of labour resources being compensated by this movement.

Figure 1. Labour resources at regional level in Romania 1990-2019 (thous. ppl.)

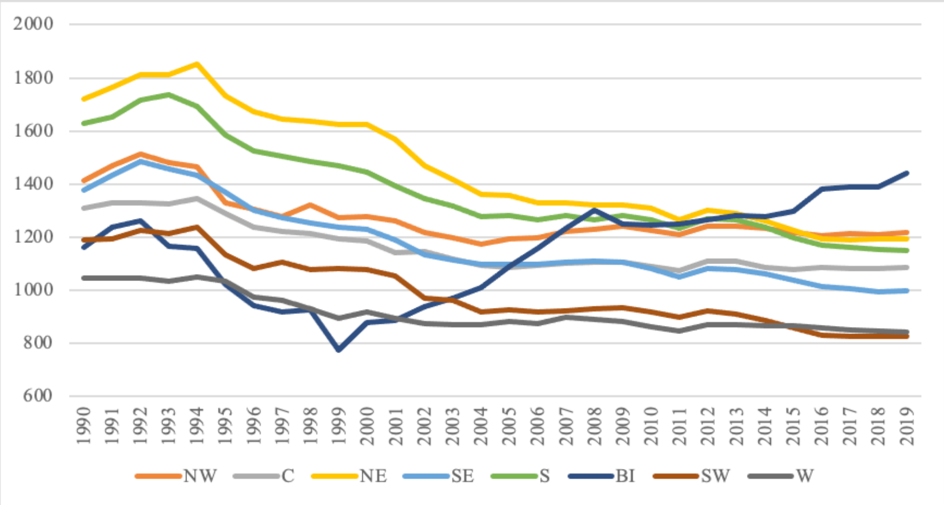


Source: Data from the INSSE National Institute for Statics of Romania, Tempo Series, 11.2020 [7]

The evolution recorded in terms of active population is dropping considerably more than in the case of labour resources. The atypical situation of the BI region displays a moderate drop over the first analysed decade, the 90's, to record a constant growth over the next two decades until present. The inland migration and the high demographic concentration of the region leads to a gain of almost 20% in actives over the last 20 years, while all other regions display a systematic decrease (Figure 2). Among the regions the NE loses about 1/3 of the active population over the analysed period while the South region (S) decreases by 1/4.

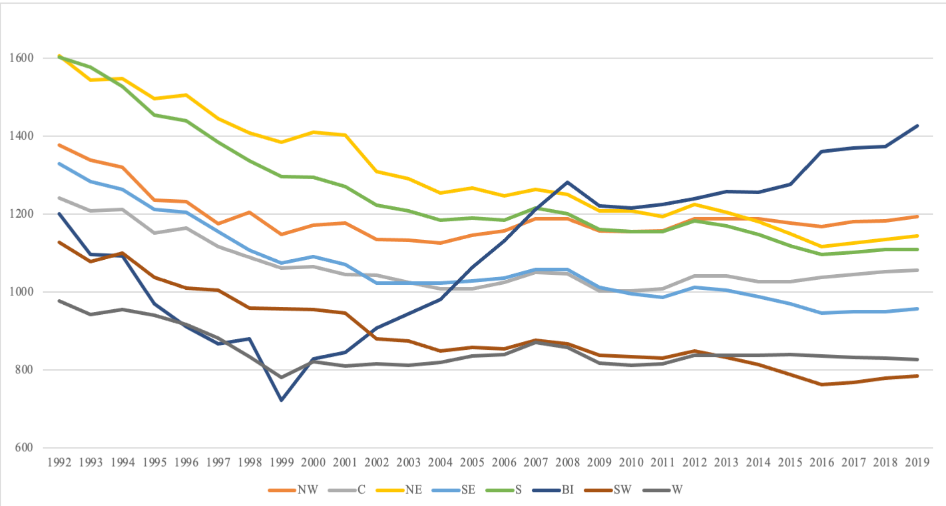
In the case of the occupied population (Figure 3) the dynamic and evolution has a similar pattern with the active population evolution the difference consisting in absolute figures and the first-tier evolution where the occupied population drops systematically across all regions. There are slight recoveries along the analysed period at the beginning of the 2000's possibly boosted by the pre-accession negotiations, the 2007 moment presumably driven by the accession of Romania to the EU and 2012-2013 period as a post-crisis boost. Although in the present the decline is still visible for regions like Northeast (NE), Southeast (SE) or Southwest (SW), a slight recovery can be observed for the Centre (C) and Northwest (NW) regions.

Figure 2. Active population at regional level in Romania 1990-2019 (thous. ppl.)



Source: Data from the INSSE National Institute for Statics of Romania, Tempo Series, 11.2020 [7]

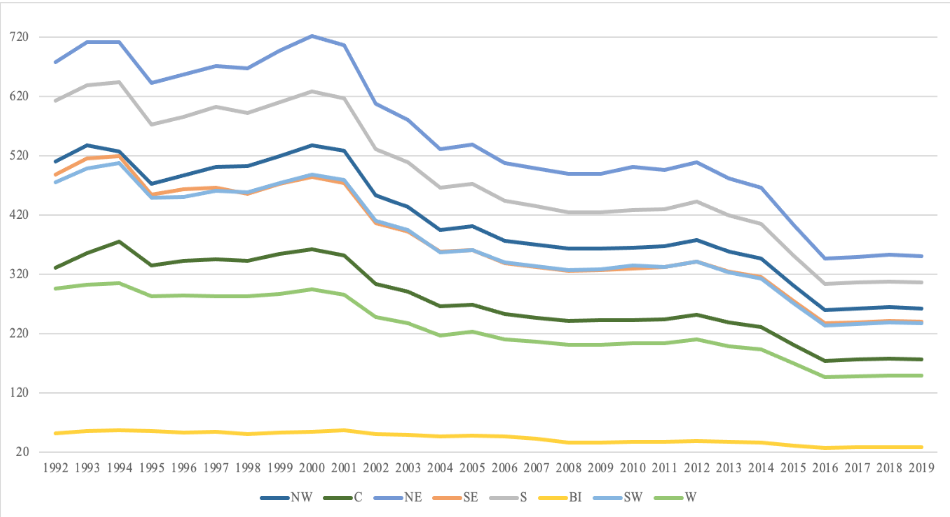
Figure 3. Occupied population at regional level in Romania 1992-2019 (thous. ppl.)



Source: Data from the INSSE National Institute for Statics of Romania, Tempo Series, 11.2020 [7]

As mentioned in the introduction, the agriculture is analysed separately for the relevant indicators as its trends and amplitude are not only consistently different, yet they influence the regional average values. The growth in occupied population from the beginning of the 90's could be coupled with the land restitution process together with the collapse of most industrial sectors and branches, also responsible for the late 90's recovery (Figure 4). The decline has continued for the next 15 years across all regions except BI where the agriculture is irrelevant, leading to a plateau stabilisation from 2016 onwards. If the agriculture has played a safety net role in the 90's the migration opportunities and income from outside the primary sector induced a reduction by half at transregional level.

Figure 4. Occupied population in agriculture at regional level in Romania 1992-2019 (thous. ppl.)



Source: Data from the INSSE National Institute for Statics of Romania, Tempo Series, 11.2020 [7]

The evolution of the total average monthly income at household level indicates, as expected, the highest values at the end of the analysed period, as a natural evolution and most probably as convergence effort after the Romania's accession to the EU. Transversally throughout all regions the indicated level moves from simple to double or more in all analysed regions over the last 12 years overlapping with Romania's performance within the first two EU budget frame. Excluding the BI region from the analysis and comparing the general national monthly average with the average incomes from agriculture we learn that regions performing well, such as Centre (C), Southeast (SE) or West (W) regions output moments were income from agriculture overpass the general average. As an example, the Centre region only falls below the level of the general average in 4 out of 12 years analysed. This can indicate a good level of modernisation and control of production factors as well as a healthy market connection. Regarding the evolution of households' average income, the general trans-sectorial average moves from a 14% to 34% as difference between the best and worst performing regions (Table 1), indicating a widening gap while for the agriculture average incomes the transition goes even wider from 53% to 137%! The highest and the lowest differences are recorded in 2012, respectively in 2015 and appear to be correlated to the agricultural output rather than to the evolution of income and general development. Worth indicating that in 2015 the gap represented, as converted, more than 500 EUR between the Centre region and the Northeast region, equivalent of more than a minimum wage on economy! Although the household average income has at least doubled over the analysed period, the structural issues from agriculture and the incidence of weather over production still play an important role in the variations of the less well performing regions.

Table 1. Total average monthly income at household level in Romania 2008-2019 (ROL)

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**MAX**	**MIN**
TO-TAL	2132	2316	2304	2417	2475	2559	2501	2687	2945	3392	4251	***4790***	**4790**	**2132**
NW	2194	2271	2308	2512	2523	2610	2642	2896	3150	3562	4516	***5192***	**5192**	**2194**
C	2133	2290	2299	2478	2504	2740	2523	2912	3056	3573	4426	***5041***	**5041**	**2133**
NE	1911	2134	2047	2175	2257	2303	2123	2177	2382	2846	3414	***3860***	**3860**	**1911**
SE	1923	2087	2030	2179	2170	2207	2139	2373	2651	3033	3706	***4257***	**4257**	**1923**
S	2059	2251	2369	2338	2435	2431	2443	2466	2696	3201	4021	***4306***	**4306**	**2059**
BI	2845	3154	3040	3122	3113	3327	3420	3672	4136	4798	6358	***6961***	**6961**	**2845**
SW	1960	2068	2134	2160	2252	2363	2285	2448	2632	2995	3638	***4210***	**4210**	**1960**
W	2184	2427	2345	2542	2733	2703	2588	2795	3127	3299	4172	***4840***	**4840**	**2184**
	Agriculture													
TO-TAL	1594	1823	1672	2086	2030	2098	2062	2181	2156	2634	2770	*2937*	***2937***	**1594**
NW	1792	2104	2022	2048	2222	2468	2385	2834	2431	3188	3407	*3508*	***3508***	**1792**
C	2338	2429	2098	3209	2477	3343	2965	4139	2517	4335	*4732*	3423	***4732***	**2098**
NE	1469	1701	1532	2003	1929	1812	1901	1748	1925	2330	2395	*2876*	***2876***	**1469**
SE	1500	1789	1501	2226	1736	1941	1988	2487	2354	2662	*3335*	2961	***3335***	**1500**
S	1534	2044	1878	1951	2203	2005	1919	1890	1995	2181	2374	*3310*	***3310***	**1534**
BI	1105	2364	1721	1624	1866	1672	1008	1663	*4215*	2088	1318	2954	***4215***	**1008**
SW	1402	1414	1317	1538	1817	1799	1782	1837	1963	2153	2151	*2182*	***2182***	**1317**
W	1829	1868	1900	2390	2652	2536	2337	1979	3899	3388	2849	*3669*	***3899***	**1829**

Source: Data from the INSSE National Institute for Statics of Romania, Tempo Series, 11.2020 [7]

In terms of expenditure the discrepancies between the regions, excluding the BI region for the large bias it introduces, are relatively temperate when compared to the expenditure. The largest differences between the best performing regions and those lagging behind amounts 20% (between 9 and 29%) along the analysed period for the average total monthly expenditure at household level (Table 2). In the case of the agricultural households and households with mainly agricultural incomes, the differences in general monthly expenditure moves from 25% in 2017 to 56% in 2012. The best performing regions, with higher levels of expenditure, are the Centre (C) and Northwest (NW) regions while the less well performing regions with the lowest levels of spending are the Southwest (SW), Southeast (SE) and Northeast (NE) regions. Comparing the average monthly income and expenditure data, in national average, the evolution is obvious, and the best levels are achieved in the last year of the analysed period, as a continuous growth trend while for the agricultural households and households with the main income from agriculture, both the worst and best years depend on the analysed region.

Table 2. Total average monthly expenditure at household level in Romania 2008-2019 (ROL).

Re-gions	**Years**													
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	***MAX***	**MIN**
TO-TAL	1915	2047	2063	2184	2244	2317	2269	2352	2524	2874	3667	4092	***4092***	**1915**
NW	2004	2055	2138	2293	2315	2398	2402	2627	2770	3162	4048	4542	***4542***	**2004**
C	1896	1984	2016	2223	2234	2471	2277	2566	2632	2987	3758	4245	***4245***	**1896**
NE	1775	1971	1909	2057	2124	2175	2030	1994	2161	2525	3090	3508	***3508***	**1775**
SE	1748	1862	1824	1978	1980	2005	1922	2068	2306	2655	3248	3799	***3799***	**1748**
S	1889	2014	2120	2091	2209	2190	2240	2180	2328	2646	3370	3627	***3627***	**1889**
BI	2388	2622	2598	2658	2680	2818	2908	3020	3336	3795	5188	5493	***5493***	**2388**
SW	1723	1770	1834	1920	2008	2132	2053	2079	2220	2564	3173	3616	***3616***	**1723**
W	1993	2185	2148	2374	2547	2512	2438	2440	2595	2764	3643	4128	***4128***	**1993**
Agriculture														
TO-TAL	1501	1723	1618	2002	1966	2038	2000	2021	1960	2382	2532	2752	***2752***	**1501**
NW	1679	1982	1987	1933	2105	2348	2184	2652	2201	2962	3199	3349	***3349***	**1679**
C	2113	2145	1854	2974	2308	3187	2807	3851	2209	3692	3262	2974	***3851***	**1854**
NE	1430	1673	1522	1950	1919	1842	1977	1658	1944	2177	2255	2768	***2768***	**1430**
SE	1402	1725	1483	2149	1644	1860	1819	2162	2060	2447	3098	2924	***3098***	**1402**
S	1489	1864	1803	1906	2172	1937	1826	1865	1860	1959	2076	2904	***2904***	**1489**
BI	1110	2115	1650	1838	1729	1604	1952	1594	3695	2061	1163	3466	***3695***	**1110**
SW	1249	1317	1263	1461	1733	1701	1708	1623	1707	2015	2110	2068	***2110***	**1249**
W	1679	1781	1818	2284	2569	2440	2207	1831	1951	2315	2640	2379	***2640***	**1679**

Source: Data from the INSSE National Institute for Statics of Romania, Tempo Series, 11.2020 [7]

The poverty risk or social exclusion rates analysed over the past 12 years indicate values above 50% for the Southwest (SW), Northeast (NE) and Southeast (SE) regions, while the best placed regions: West (W), Northwest (NW) and Centre (C), have the lowest rates at 22-24% (Table 3). In this case, even the BI region is relatively close to the immediate followers by a distance of less than 2%! Most regions have tempered over time the high rates of poverty or exclusion risks by reducing them to half when compared to the beginning or the middle of the period, except a considerably lesser change in the case of the Northeast region (NE) from 56,7% to only 43,9% and the Southwest region (SW) from 57% to only 40,9%. These extremely high values for an EU member state and particularly high variations across the regions indicate serious issues in the efforts to increase the living standards under the convergence objective.

Table 3. Poverty risk or social exclusion rates in Romania, 2007-2018 (%)

Regions	**Years**													
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	***MAX***	**MIN**
NW	*39,2*	34,9	36,2	32,1	35,2	33,5	32,3	32,1	28	29,3	26,4	22,3	***39,2***	**22,3**
NE	*56,7*	55,5	52,9	52,4	51,7	52,1	51,5	49,4	46,3	46	43,9	44,7	***56,7***	**43,9**
SE	52,9	46,7	42,6	51,7	49,6	*54,1*	53,9	53,2	46,2	44,9	42,5	40,3	***54,1***	**40,3**
W	33	34,3	31,8	36,2	34,6	*41,7*	40,4	40,1	32	40,7	32,5	22,1	***41,7***	**22,1**
C	*39,5*	39	33,3	31,3	30,6	34,3	36	35,7	31,6	29,5	25,7	24,4	***39,5***	**24,4**
S	*52*	46	47,6	42,8	43,5	45,5	42	41,7	43,5	41,2	40,9	36,3	***52***	**36,3**
BI	*37,3*	34	40,3	32,7	29,7	31,4	30,7	25,1	20,5	32,9	25	21,4	***40,3***	**20,5**
SW	*57*	56,6	53,2	47,5	45,8	48,4	44,6	40,9	41,9	44,2	45,3	42,2	***57***	**40,9**
TOTAL	*47*	44,2	43	41,5	40,9	43,2	41,9	40,3	37,4	38,8	35,7	32,5	***47***	**32,5**

Source: Data from the INSSE National Institute for Statics of Romania, Tempo Series, 11.2020 [7]

The highest rates of relative poverty are recorded in the same regions: Northeast (NE) with 36,6% and Southwest (SW) with 37,6%, while the lowest rates are recorded in the BI region with 2,6% and the West (W) region with 9,8%. The almost 30% difference between two neighbouring regions (37.6%/9,8%) are difficult to explain even taking into account the severe drain of labour from the SW region towards the major cities in Romania or abroad. Also, the lowest rate in the W region was recorded more than a decade ago, in 2007, and during the last tier of the analysed period the rates moved between 14,9% (2018) and the peak of the period of 27,5% in 2014, yet the SW region never reached a level inferior to the highest rate in the W region. The Northeast (NE) region never recorded rates under 30% having every third citizen exposed to relative poverty during the EU integration process.

Table 4. Relative poverty rate in Romania, 2007-2018 (%).

Re-gions	**Years**													
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	***MAX***	**MIN**
NW	20	20	18,5	15,8	*20,6*	17,4	17,1	20,4	19,2	17,1	19	17,5	***20,6***	**15,8**
NE	36,6	33,4	31,1	30,8	32,1	31,7	34,5	36,1	35,9	*36,1*	33,4	35,6	***36,6***	**30,8**
SE	30,2	26,1	21,9	27,8	29,2	31,9	32,2	*34*	32,4	31,2	29,6	31,2	***34***	**21,9**
W	9,8	16,1	16,1	20,3	20,5	25,8	22,7	*27,5*	19,8	25,1	21,4	14,9	***27,5***	**9,8**
C	18,2	*21,6*	19,6	20,5	18,7	18	18,2	20,4	17,8	20,8	17,3	19,4	***21,6***	**17,3**
S	26,8	22,9	22,4	21,2	21,1	22,1	22,7	25,5	*30,6*	24,8	24,9	25,7	***30,6***	**21,1**
BI	8,9	5,6	6	3,4	3,5	2,6	4,1	4,8	5,9	*10,2*	6,1	4,1	***10,2***	**2,6**
SW	36,9	*37,6*	37,3	29,1	28,1	31,2	28,2	28,3	32,1	34,2	33,4	34,3	***37,6***	**28,1**
TO-TAL	24,6	23,6	22,1	21,6	22,3	22,9	23	25,1	*25,4*	25,3	23,6	23,5	***25,4***	**21,6**

Source: Data from the INSSE National Institute for Statics of Romania, Tempo Series, 11.2020 [7]

The severe material deprivation rates at regional level are highlighting the same outperforming regions with the Southwest (SW) region oscillating between 17,8% and 46,7% at the boundaries of the analysed timeframe, followed by the Southeast (SE), South (S) and region Northeast (NE) regions all of them with peak rates above 40% (Table 5).

Table 5. Severe material deprivation rate in Romania, 2007-2018 (%).

Re-gions	**Years**													
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	***MAX***	**MIN**
NW	30,4	25	24,3	21,8	24,2	22,7	21,9	18	16,5	17,6	11,9	9,3	***30,4***	**9,3**
NE	43,5	40,5	41,9	40,3	38,6	37,5	34,5	30,4	26,7	23,8	22,4	19,8	***43,5***	**19,8**
SE	43,9	34,3	31,1	38,4	35,2	36,8	38,7	34,4	32	29,9	25,8	22,3	***43,9***	**22,3**
W	25,2	22,8	20,6	22,8	20,4	26,4	***28,8***	22,7	16,4	22	13,8	7,8	***28,8***	**7,8**
C	29,7	27,3	21,2	19,7	18,9	23,5	27,2	25	21,9	18,3	13,2	10,4	***29,7***	**10,4**
S	43,6	36,5	36,9	32,2	33,2	35,9	30	28,4	26,8	27,5	25,8	23	***43,6***	**23**
BI	34,6	30,8	36,7	30,2	27,4	28,6	27,3	19,8	**13,7**	25,4	19,1	19,3	***36,7***	**13,7**
SW	46,7	39,2	38,1	32,7	31,7	32,6	27,1	25,3	20,8	24,4	22	17,8	**46,7**	**17,8**
TO-TAL	38	32,7	32,1	30,5	29,5	31,1	29,8	25,9	22,7	23,8	19,7	16,8	**38**	**16,8**

Source: Data from the INSSE National Institute for Statics of Romania, Tempo Series, 11.2020.

In the case of the severe material deprivation rates all regions except BI region present the lowest rates in the last analysed year, certain of them reducing the previous year rate by almost half, such as in the case of the West (W) region, moving from 13,8% to 7,8%.

Conclusion

The developments recorded over the past three decades led to a considerable improvement for all the economic sectors in all regions of Romania. The situation of the agricultural households and agriculture generally speaking, as income generator, are far from being stabilised after two budget periods as an EU member state. Active population in the sector along with self-employed people outside agriculture are the most exposed to unpredictable changes in economy or nature. The largest region in Romania in terms of population still underperforms at all chapters with every third citizen in a situation of relative poverty as in the case of the Northeast region. In the same region (NE) almost every second citizen (44,7%) is exposed to the risk of poverty or social exclusion. The opposite geographic position of the Southwest region, neighbouring one of the wealthiest regions in the country, the West region, doesn't change the previously depicted situation of NE region as in terms of total average monthly income at household level, the agricultural households earn the lowest income in Romania as 30-50% of the other regions.

The factors that led to this situation and even more that further maintain this situation are basically of structural origin: the low speed land restitution process (over a decade), the absence of a land cadastre still in the present days, the dual speed agriculture with many small farms and agricultural households (the largest number in EU) and also many large and very large farms coupled with a low level of professional education for the farming population (over 97% with practical training only), high rates of activity [3] for the elderly rural population as the social coverage and pensions proves insufficient for decent living [5, 7].

The common frame of equal access to development opportunities offered by the EU and national programmes and funds [2, 4] are not sufficient for and not enabling the reduction of the described regional discrepancies. Further efforts to focus on development objectives and by objectives in an integrated planning and programming manner [1, 5] are required along with a new organisational philosophy or regional and administrative organisation [6].

Literature

1. 80 simplification measures in cohesion policy 2021-2027: https://ec.europa.eu/regional_policy/sources/docgener/factsheet/new_cp/simplification_handbook_en.pdf, (accessed: November, 2020).

2. New Cohesion Policy, https://ec.europa.eu/regional_policy/en/2021_2027/, (accessed: November, 2020).
3. Rural Development, https://ec.europa.eu/regional_policy/en/policy/themes/rural-development/, (accessed: November, 2020).
4. THE EU RURAL DEVELOPMENT POLICY: FACING THE CHALLENGES, European Communities, 2008: http://enrd.ec.europa.eu/enrd-static/fms/pdf/2067BB37-F930-016B-4338-41FC992B5F58.pdf, (accessed: November, 2020).
5. What is new in the new EU rural development policy agenda? https://sea-conference.eu/wp-content/uploads/2020/10/Session-J-Rega_New-policy-frame.pdf, (accessed: November, 2020).
6. EU Rural Development Policy, Marie-Laure Augère-Granier, https://epthinktank.eu/2015/09/25/eu-rural-development-policy/, (accessed: November, 2020).
7. INSSE National Institute for Statics of Romania, Tempo Series http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table, (accessed: November, 2020).

BIOEAST INITIATIVE AND BIOEASTSUP PROJECT: RESULTS OF CEE COUNTRIES COOPERATION FOR BIOECONOMY

Dan Marius Voicilas[1]

Abstract

As the bioeconomy concept is one of the main trends in economy, the new national policies and strategies promoted by countries must adhere to the lines established at the EU level. For European countries, both EU and non-EU, the bioeconomy will have a major role in their national economy. The aim of this paper is to set forth the bioeconomy concept in EU and the main actions for Central and Eastern European countries in this field, thus far. These are BIOEAST Initiative and BIOEASTsUp H2020 Project. For this analysis, we use official documents created at the EU level by the EU institutions, along with the results from the BIOEAST Initiative and BIOEASTsUP project. The research, which is based on document analysis, comparisons and forecast, offers a broad view on the bioeconomy strategy at the EU level and especially on the level of the development for the CEE countries.

Key words: *bioeconomy, EU strategy, CEE countries, Bioeast initiative, BioeastsUp project.*

Introduction

The bioeconomy is a relatively new concept. The term as such has been used since the 90s by Juan Enriquez Cabot and Rodrigo Martinez, but their work has referred to their research in genetics. Earlier in the 60s, economist Zeman used the term "bioeconomics" when he said that bioeconomics "designate an economic order that appropriately acknowledges the biological bases of almost all economic activities". The American economist of Romanian origin Nicolae Georgescu Roegen also wrote about bioeconomics/bioeconomy in an article from the 70s, in which he concluded from personal professional experience that "unlimited growth would not be compatible with the basic laws of nature". Moreover, another Romanian scientist, Grigore Antipa, used the term bioeconomy in the 30s in one of his works published in the "Bulletin de la section scientifique" of the Romanian Academy. It is entitled "La biosociologie et la bioeconomie de

1 Dan Marius Voicilas, Ph.D., Associate Professor, Senior Researcher, Romanian Academy, Institute of Agri cultural Economics, Casa Academiei, Calea 13 Septembrie no. 13, sector 5, 050711 Bucuresti, Romania, Phone: +40 722 398 119, E-mail: dmvoici@yahoo.com

la Mer Noire" and was printed in 1933. Therefore, from the studies and publications we have had access to so far, we can consider that the origins of this term are in the 30s, and the father of "bioeconomy", in Romania, is Grigore Antipa. However, the term bioeconomy in the present sense began to be promoted after 2000 by Christian Patermann, who was Program Director of "Biotechnology, Agriculture and Nutrition" in the Directorate General for Research, Science and Education of the European Commission. Through his initiatives, debates, and conferences on this topic, Patermann has succeeded in convincing policy makers of bioeconomy importance for the present times and the inclusion of the concept in position papers, policies and strategies developed at European Union (EU) level. (EC, 2018).

There are several definitions of bioeconomy. It is not a single definition, unanimously accepted in the literature. They generally use the same terms to define the concept. Regardless of how the bioeconomy is defined, after 2012 it appears more and more often in the official documents. For example, the European Commission (EC) states "Bioeconomy comprises those parts of the economy that use renewable biological resources from land and sea – such as crops, forest, fish, animals, and micro-organisms – to produce food, materials and energy." (EC, 2012) The BIOEAST initiative defines bioeconomy approximately similarly as EC, namely "The bioeconomy encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy independently of the processing technologies. It thus includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, bio-technological and energy industries." (www.bioeast.eu) In a simple way we define bioeconomy as: A complex system composed of natural resources and their transformation processes, which belong to biology, and which contribute to the economic, social and cultural development of people in a sustainable way, based on knowledge, forethought and empathy.

Objectives, methodology and data

The aim of this paper is to present the concept of bioeconomy and the bioeconomy strategies development in Central and Eastern European (CEE) countries. The countries formed a government partnership called the BIOEAST Initiative in the field of bioeconomy. The 11 partner countries aim to develop the bioeconomy and the national bioeconomy strategy, in a unitary way for this macro-region of Europe and in accordance with the EU Bioeconomy

Strategy. We also present a result of the CEE cooperation, namely the Horizon 2020 BIOEASTsUP Project.

For the realization of this study were used the official documents of the EC and other European institutions with attributions in the field, national documents of the CEE member countries, but also results and documents of the BIOEAST Initiative and BIOEASTsUP Project. To achieve the proposed objectives, a literature review, a text analysis of the studies and documents in this field, as well as comparisons between the analysed states were performed.

Results

CEE countries and Bioeast Initiative

In EU, only 15 countries have, or are going to have in short time, dedicated bioeconomy strategies, that show how difficult and slow the process is after 8 years when entered in force the first Bioeconomy Strategy at EU level. From CEE, only Latvia has a Bioeconomy Strategy. Other five (Croatia, Czech Rep., Lithuania, Poland, Slovakia) have strategies under development and the rest, including Romania, have other kind of related policies initiative and strategies (https://ec.europa.eu/knowledge4policy/visualisation/bioeconomy-different-countries_en).

Figure 1. BIOEAST countries.

Source: www.bioeast.eu

BIOEAST Initiative means "The Central-Eastern European Initiative for Knowledge-based Agriculture, Aquaculture and Forestry in the Bioeconomy. The partnership is a policy initiative. It was initiated by the Visegrad countrie

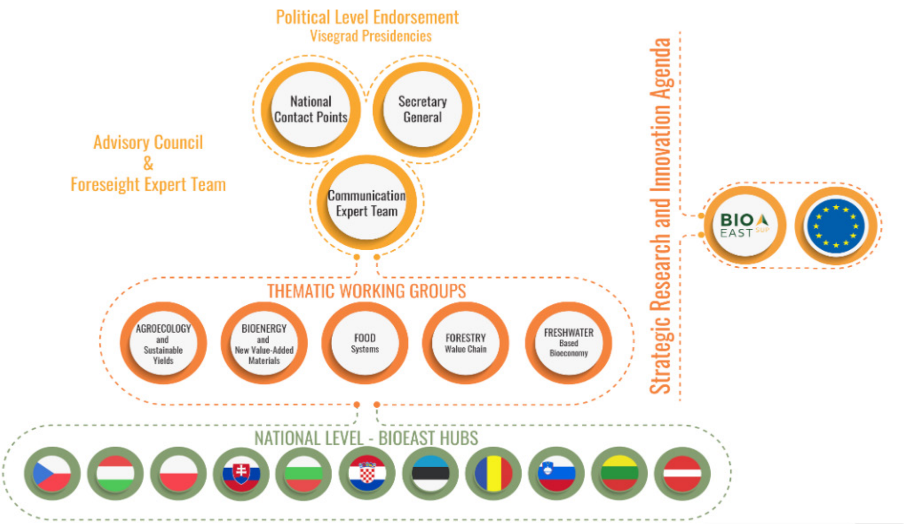
(Czech Rep., Hungary, Poland, Slovakia). Later, other countries joined it: Bulgaria, Croatia, Latvia, Lithuania, Estonia, Romania, and Slovenia. (Figure 1). It was officially born in 2014.

BIOEAST offers a common political commitment and shared strategic research and innovation framework for working towards sustainable bioeconomies in the CEE countries. Only the ministerial bodies can become members. CEE countries are encouraged to promote and include on their political agenda the objectives of the Initiative. There were four political declarations signed by Agriculture Ministers of the Initiative, to support it: November 2016 (Warsaw), September 2017 (Visegrad), June 2018 (Babolna), May 2019 (Stara Lesna/Brussels).

The Mission of the BIOEAST Initiative is "the development of knowledge and cooperation based circular bioeconomies to enhance inclusive growth in the BIOEAST countries and create new value-added jobs especially in rural areas, maintaining or even strengthening environmental sustainability" (www.bioeast.eu). The Initiative assists the CEE countries in implementation of the Vision for 2030 having in view their potential and offering opportunities for: "A sustainable increase of biomass production, to become competitive and leading, high quality, food and feed producers worldwide; A circular (zero waste) processing of the available biomass, to become key players in the development of new bio-based value chains; Viable rural areas (to develop an innovative, inclusive, climate-ready growth model)" (www.bioeast.eu). Through the governmental initiative, CEE countries set the Vision for 2030. The scope is: "Strategic thinking in bioeconomy; Quality Food and Feed for Europe and for the World; Industrial boost for rural areas" (www.bioeast.eu). Within this scope, general objectives are set to address the challenges to achieve the overarching mission, namely: "develop strategies; cooperate and develop evidence-based policies; identify common challenges and validate common research areas; provide the evidence base; improve skills; develop synergies; increase visibility" (www.bioeast.eu). The key activities of the BIOEAST Initiative are: "To develop ministerial level intergovernmental joint declarations; Common research and innovation agenda; Position papers and strategic policy advice" (www.bioeast.eu). To do this, there is a need to mobilise research organisations, administration, industry, NGOs, and the public (stakeholders). Together, at the same table of discussion, they can reach the objectives proposed. Thus, we can define the national BIOEAST HUBs as networks that gather the national stakeholders and support their engagement.

The main working body of the BIOEAST Initiative is the BIOEAST Board composed of the Secretary General and National Contact Points. Within partnership, 5 BIOEAST Thematic Working Groups (TWG) were established at macro-regional level to support the work of the BIOEAST Board in specific strategic areas: Agroecology, Bioenergy, Food systems, Forestry, Water. In frame of Bioenergy TWG, a subgroup was created. It is "Bio-based materials" and is coordinated by RO, together with HU. The governance structure of the Initiative is presented in Figure 2.

Figure 2. Governance structure of BIOEAST Initiative



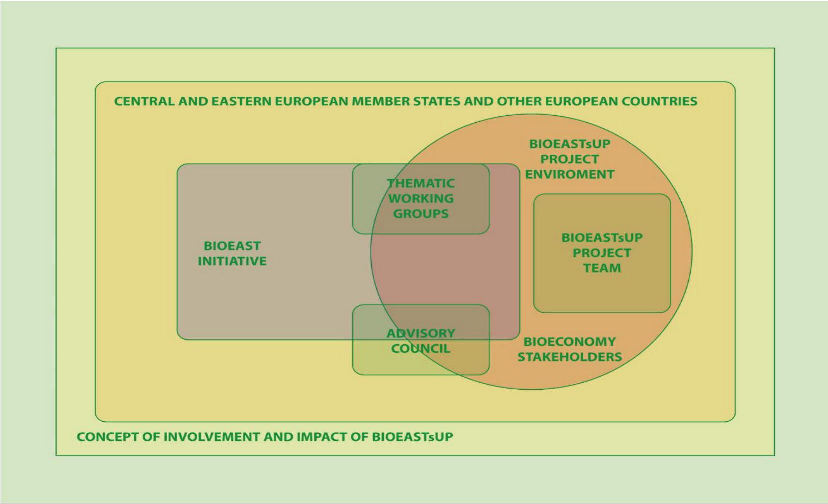
Source: www.bioeast.eu

In line with the implementation of the BIOEAST Vision 2030, panel of experts will be set up as Advisory Council to support the BIOEAST Initiative. The Advisory Council will work as a bioeconomy panel for the macro-region. The aim is to give guidance to national policy makers but also to identify special challenges the macro-region might face with, and to contribute to the BIOEAST Strategic Research and Innovation Agenda (SRIA). In line with the implementation of the BIOEAST Vision 2030, and in the framework of the BIOEASTsUP Project, a macro-regional BIOEAST Foresight Exercise is being conducted to support the BIOEAST member states in developing their sustainable bioeconomies. Five, high-level independent CEE experts have been selected by the BIOEAST Board. The experts and ultimately the BIOEAST Foresight report shall look into the future perspectives of the macro region's bioeconomies (2030-2050) and at the same time setting it in the wider EU and global context, investigating the special characteristics of the macro-regional bioeconomy deployment, special needs and potential with possible scenarios. It aims to raise awareness about current and future challenges for the national policy developments, to improve the policy framework to address long-term challenges, and to provide advice for the BIO-EAST SRIA development.

BioeastsUp Project

In 2019, BIOEASTsUP (Advancing Sustainable Circular Bioeconomy in Central and Eastern European countries) project was funded by the H2020 RUR-2019-1 for the period 2019-2022, with the main aim to support the BIOEAST Initiative in the implementation of its Vision for 2030 and Action Plan. It is a "Support action" project. We can consider it the first main result of the BIOEAST Initiative. BIOEASTsUP Project was designed in a parallel setting with BIOEAST Initiative. The links between BIOEAST Initiative and BIOEASTsUP Project are presented in Figure 3. BIOEASTsUP delivers coordinated and integrated actions to promote the uptake of national strategies, mobilize research and innovation to develop bio-based value chains by involving stakeholders. The actions set up a framework and capacity for systematic approach of evidence-based policy for sustainable circular bioeconomy, especially in rural areas.

Figure 3. Links between Initiative and Project



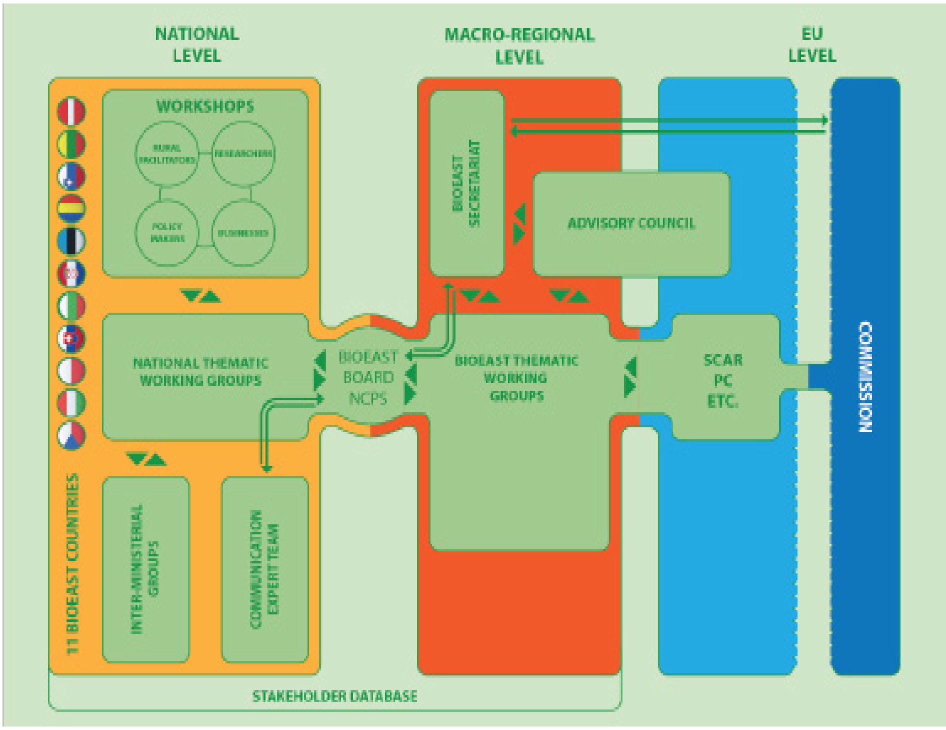
Source: BioeastsUp Project

The consortium has 21 partners from all CEE countries that built BIOEAST Initiative. Among them, the Institute of Agricultural Economics from the Romanian Academy. 11 BIOEAST countries participate in this consortium, plus Finland (FI) and Germany (DE). Besides consortium's partners, other entities support the project: ministries (26 in total), entities from central and local administration, different stakeholders like associations, innovation centres, industrial chambers, universities, research centres and NGOs. The Project wants to engage all these actors in the construction of the bioeconomy and maximize the impact. To achieve the EU Circularity and Sustainability goal under the auspice of bioeconomy, BIOEASTsUP develops an open and inclusive platform which is community driven. It is a platform that aimed at reaching a wider array of the community at the Member states level. Fostering such networks with downstream and upstream linkages to traditional value chains multiplies impacts comparing with conventional value chains. The scope relies on implementation of the BIOEAST Initiative's Vision Paper and Action Plan by assembling a multi-actor polyvalent consortium from all BIOEAST countries, macro-regional cooperation of national institutes from public administration, ministries, academia, and stakeholder representatives including two partners from leading countries in bioeconomy (DE, FI).

The specific objectives of the project are: "To trigger strategic thinking at governmental level and transnational peer-to-peer development of national circular bioeconomy strategies in BIOEAST countries; To emphasize the role of multi-actor approach in developing new value chains to advance bioeconomies; To develop in a multi-stakeholder driven approach a consolidated BIOEAST SRIA; To set-up and maintain a macro-regional framework in support of the BIOEAST initiative and the SRIA development and sustainability; To facilitate evidence-based policy making; To increase the visibility of the bioeconomy within the quintuple helix in the BIOEAST region" (https://bioeast.eu/bioeastsup/). The work plan of the project is as follows: "Framework for National Bioeconomy Strategies Development; Capacity building for BIOEAST stakeholders; Establishing macro-regional structures in support of the BIOEAST initiative; BIOEAST SRIA development and positioning the macro-regional economies; Communication, Dissemination and Exploitation; Project Management and Evaluation" (https://bioeast.eu/bioeastsup/). Two of the work packages are focused on the national impact and other two are dedicated to the impact at the macro-regional and EU level. The activities consist of operational, policy building and supportive activities (Figure 4):

- Operational activities: integration and efficiency between BIOEASTsUP Project and BIOEAST Initiative;
- Policy activities: to build up the strategic framework for the national bio-economy strategy building and the macro-regional SRIA;
- Supportive activities: to support the BIOEAST Initiative structure.

Figure 4. BioeastsUp activities on national, macro-regional and EU level



Source: BioeastsUp Project

BIOEASTsUP activities aim for institutional enhancement, capacity building and supporting evidenced-based policy making. Project activities are strongly connected to the already existing institutional framework of the BIOEAST Initiative and its stakeholders and will be strictly driven by the needs expressed by them. This will ensure results which meet stakeholder demands and expectations, create ownership and therefore foster long-term sustainability, exploitation, and embedment in BIOEAST activities beyond the duration of this project. BIOEASTsUP Project has a bottom-up approach.

Conclusions

The results of this study permit us to mention a few main conclusions. Obvious, CEE countries are one step behind Western EU countries. There is a different historical evolution, also many present challenges that CEE countries make face. Among challenges, it is worth mentioned: the deadlock of the research and innovation; difficulties in the bio-based value chains; governance blockage; the indifference from the society; financial barriers. At the same time, there are threats that can obstruct the plans of the CEE countries. The main we have identified are the political involvement and will, as well as seriousness. They can be the strong barriers for the development of the strategies. Besides these challenges and threats, there are positive premises for fast development of the national Bioeconomy Strategies and Action Plans. First, there is interest from the actors involved, other than the politicians, to build them. Then, the future financial programming period force, in a way, the EU member states to develop faster their strategies. CEE countries have chances to burn the stages and recover the time lost. We identified that the national institutions involved in these activities exists, they are willing to participate and have human potential. Ministry of Agriculture is a common ministry that leads the Bioeconomy Strategy construction for all countries, which shows the importance of agriculture for bioeconomy strategy and the role the agriculture will play in the future in the new national strategies and policies. Also, BIOEAST Initiative is the common action for all 11 CEE countries. We consider that, the Initiative and the Project, will help the countries from CEE to create and implement their national strategies in very short time and then to contribute, all together, to the development of the bioeconomy macro-regions in this area. In this way, the gaps between Western and CEE countries will be attenuated and the benefits will appear. Among them, the benefits from the next financial programming period 2021-2027, in terms of dedicated programs and funds for bioeconomy, either they are for research, or business, public or private sectors. The absorption of the funds will be a priority for all CEE countries. In this context, the new EU bioeconomy concept-Horizon 2030 for CEE countries can have 2 main slogans: “Use better what we already use”, “Use well what we do not use yet”.

Acknowledgements

Parts of the results of this study are based on the analyses carried out within the Horizon 2020 project “Advancing Sustainable Circular Bioeconomy in Central and Eastern European countries” (BIOEASTsUP), funded by the European Commission for the period 2019-2022, under grant agreement no. 862699 and results from BIOEAST Initiative

Literature

1. European Commission, (2018): *A sustainable bioeconomy for Europe: strengthening the connection between economy, society and the environment-Updated Bioeconomy Strategy*, European Commission, Directorate-General for Research and Innovation Unit F – Bioeconomy, Print ISBN 978-92-79-94145-0 doi: 10.2777/478385 KI-04-18-806-EN-C, PDF ISBN 978-92-79-94144-3 doi:10.2777/792130 KI-04-18-806-EN-N, Brussels, Belgium, https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf (10.09.2020)
2. European Commission, (2012): *Innovating for Sustainable Growth-A Bioeconomy for Europe*, Directorate-General for Research and Innovation, ISBN 978-92-79-25376-8, doi 10.2777/6462, Luxembourg: Publications Office of the European Union

Internet sources:

3. https://bioeast.eu/ (accessed 25.11.2020)
4. https://bioeast.eu/bioeastsup/ (accessed 25.11.2020)
5. https://ec.europa.eu/knowledge4policy/visualisation/bioeconomy-different-countries_en (accessed 25.11.2020)

THE ROLE OF SOIL BIOTA IN AGRICULTURE: ENHANCING ECOSYSTEM SERVICES IN BULGARIAN FARMS

Kristina Todorova[1]

Abstract

Agricultural activities in some cases might disrupt the natural soil condition and create environmental risks. However, in recent years there is a tendency for a positive change in farmers' awareness and attitude towards conservational practices, such as provision of agri-environmental and organic agriculture. The aim of this paper is to present the potential for enhancing soil fertility as ecosystem service in farmlands in Bulgaria. This paper presents several practices in Bulgaria, which are believed to have the potential for maintaining good environmental status of soils, hence the provision of soil fertility as ecosystem service.

Key words: *ecosystem services, soil quality, organic farming.*

Introduction

Agricultural intensification and the resulting stress on natural ecosystems, has provoked the shift of the modern agriculture towards more green and conservational model. The next period of the Common Agricultural Program (CAP) 2021-2027 suggests even more ambitions "Green deal". Conservational agriculture can have important environmental benefits, such as biodiversity protection, enhanced soil fertility, reducing flood risk and excess run-off and to decrease soil erosion. On the other hand, negative externalities can also occur due to unsustainable agricultural practices which in turn can impose threat to the natural environment. Multifunctionality in agriculture can include diverse outcomes not only connected to food provision, but regarding other environmental and social benefits (Woods, 2011). In fact, multifunctionality in rural areas can be seen as another instrument for delivering ecosystem services. One of them concerns soil formation and fertility.

Soil quality is compiled of several main features, that make soil resources irreplaceable. This paper will focus mainly on soil fertility as a result of natural processes, that include the immense role of soil microbiota. Soil fertility

1 Kristina Todorova, Ph.D., Assistant Professor, University of National and World Economy (UNWE), Department for Economics of Natural Resources, Student Town, 1700 Sofia, Bulgaria, E-mail: ktodorova@unwe.bg

is a supporting ecosystem service.[2] Soil microbes play immense role in plant development and nutrient cycle. Without the role of microorganisms, it would not be possible for the plants and animals to absorb essential elements from the soil. As a result of the nitrogen-fixing bacteria in soils (*Azotobacter, Clostridium, Rhizobium, and other genera*), every year around 60-75% of this element enters into the soil nitrogen cycle, thus giving food for the plants. Nitrogen is the most important organic element of life itself. It is part of the protein molecules in every single living organism. Nitrogen is an essential element and structural component of the chlorophyll molecule, necessary for the photosynthesis. The biological nitrogen fixation is the main processes that lead to soil fertility. In fact, soil microbiota can adapt to certain conditions within the soil, which determines the specific role in the soil regulation processes (Li, et al., 2020; Su, et al., 2017). However, modern agriculture uses chemical fertilizers as a mean for increasing soil fertility, in some instances more than needed.

Some studies show (Kochakinezhad et al., 2012, Sofyan et al., 2019) what is the effect of organic and inorganic fertilizers on different crops. It is without dispute, that inorganic mineral fertilizers have increased the yield of crops, but at the same time triggered biological damage of the soil and its natural functions. The use of chemical fertilizers, but not only, could accelerate the process of soil acidification as well as to have impact on water saturation capacity and soil microbiota activity (Ge et al., 2018; Korschens, 2006; Leroy et al., 2008). Fertilizers can have direct effect on structure and functions of soil microbial communities, (Shi et al., 2020) which can decrease significantly with fertilization (Gu et al., 2019). Only 30–40% of the chemical fertilizers are utilized by the plants (Prasad, 2009). The rest in the form of pollutants can cost between 70-350 billion euro per year for the whole European Union (Sutton et al., 2011). On the other hand, the use of organic compounds such as manure or bio fertilizers could improve the soil quality (Liang et al., 2020). Organic agriculture in comparison with conventional can lead to higher organic matter and an increase in the total microbial population (Kochakinezhad et al., 2012). From an environmental point of view, it is more than reasonable to put a question mark on the excessive use of inorganic fertilizers and to try to put focus on the organic conservational methods, which will form the basis of the new green architecture of the next period of the CAP.

2 Defined by the Millennium Ecosystem Assessment network https://www.millenniumassessment.org/en/index.html

Conventional tillage as a farming method is believed to have had negative impact on the environment, causing excessive fragmentation and compaction of soil, excessive runoff and flood risk. Some studies show, that conventional tillage can have many other negative impact on soil fertility (Gathala et al., 2011; Mathew et al., 2012), thereby threatening sustainable crop production. Alternative to that can be conservation techniques such as minimum tillage and zero tillage. Studies have analysed the impact of conservation tillage on the rhizosphere bacteria and therefore on the soil fertility (Ziting et al, 2017; Guo et.al. 2015; Helgason et al., 2018), with the resulting conclusion that conservation tillage with abundant soil nutrients creates favourable aeration of soils and enhance the stability of rhizosphere bacterial diversity. Conservation tillage can improve soil microorganism dynamics improving the environmental conditions.

Irrigation methods are another aspect having a great influence on soil structure and fertility. The most commonly used types of irrigation are furrow irrigation, sprinkler and drip irrigation. Furrow irrigation is one of the oldest and most used practices, but it has created problems with waterlogging, increase salinity, soil erosion, reduction in the overall irrigation efficiency, soil nitrogen leaching (Huang et al.,2018). Sprinkler irrigation and drip irrigation can have many more positive long-term effects on soil and lead to higher economic efficiency, including saving water, higher crop yields, increased fertilizer efficiency, reduced risk of erosion, better soil moisture (Asadi et al., 2002; Michael, 2008; Tagar et al. 2012).

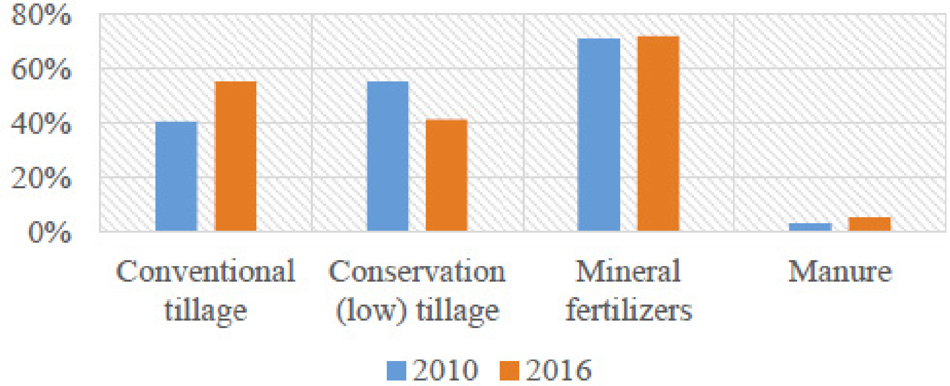
Different factors are found to influence the implementation of conservational practices in farmlands (Todorova, 2019). Some of them concentrates around the pure economic maximization effort (individual utility), while others tend to include also altruistic behaviour of the farmers, recognizing the value of nature in decision-making process. There are many ways in which ecosystem services provision can be improved, but currently in Bulgaria the most used policy tool is by implementing agri-environmental measures and organic farming schemes under the CAP. The transition to a more conservational agriculture still represents difficulty for the Bulgarian farmer. However, currently there are several practices, which can lead to the provision of soil fertility. These include agri-environmental practices such as conservational tillage, use of organic fertilizers (manure) and all good practices included in the organic farming as a model of agriculture.

Discussion

Conservation tillage and the use of organic compounds (bio fertilizers, manure) have proved to have positive impact on the microbial organisms in soils, thus increasing soil fertility. In this study it is shown how these practices have been applied in the Bulgarian agriculture – level of implementation of conservation tillage, level of use of manure as organic compound, and level of organic farming. Finally, types of irrigation systems are shown, as another practice in the agriculture which has proven to have influence on soil fertility and structure.

On Figure 1 tillage methods and applied fertilizers are compared for 2010 and 2016 as a share (in %) of the total utilized agricultural area (UAA).

Figure 1. Tillage methods and applied (share of UAA in %)

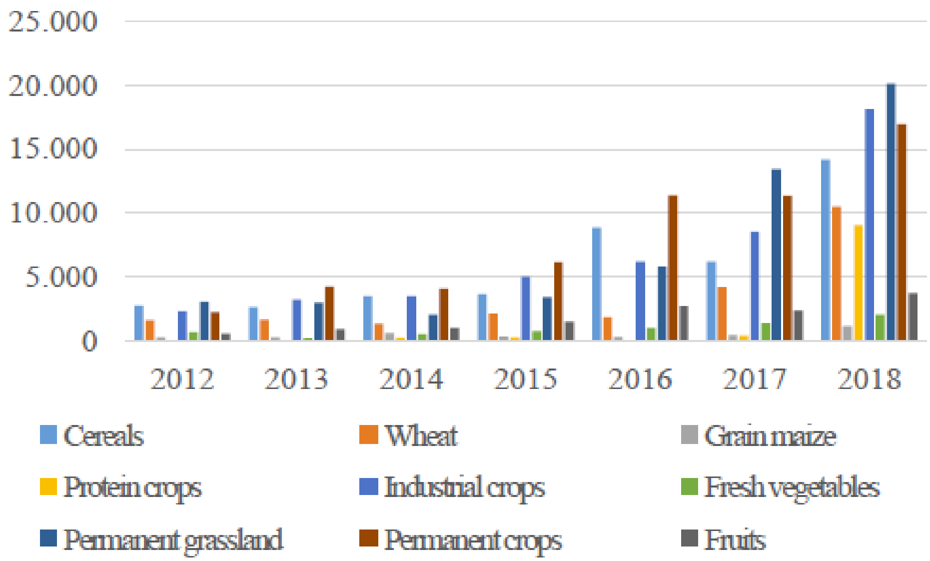


Source: National statistics of the Ministry of Agriculture in Bulgaria

Conservational tillage has decreased, while the conventional tillage has gone into the opposite change and currently it can be said that this one is the predominant practice. Zero tillage is not shown, since its share is negligible – less than 1% for both years. Organic fertilizers in the form of manure have a very little and negligible share – only 5,3% for 2016. While the share of the inorganic fertilizers is about 71-72%.

Bulgaria has a rapid growth in the areas under organic farming. The fully converted organic area as a share of the UUA has risen from 0,23% in 2012 to 1,68% in 2018 (Figure 2). Yet, this share is really small compared to Sweden (17,87%), Estonia (17,44%), but actually it represents the largest grow rate compared to the whole EU-28.

Figure 2. Area under organic farming (in ha)

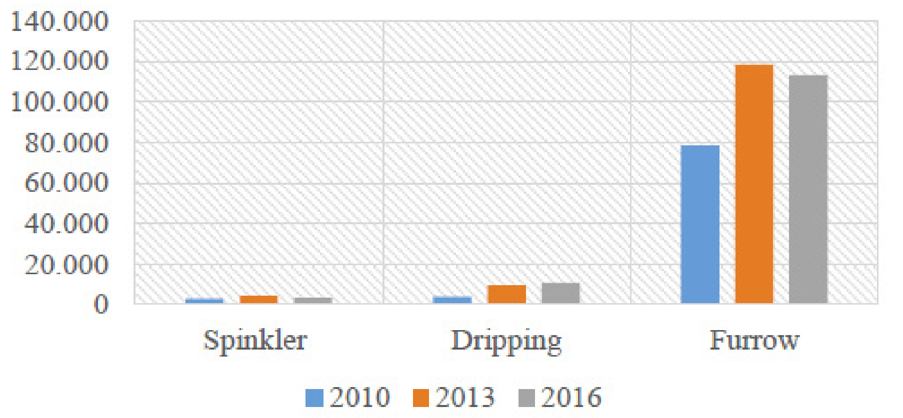


Source: Eurostat – organic farming

All categories show increase for the period 2012-2018, with the highest one for the protein crops – from only 47 ha in 2012 to nearly 9000 ha in 2018. This is a good news for the nitrogen in soils, since protein crops have a high soil enrichment capacity via symbiotic relationships with certain bacteria. As a share, the biggest part in 2018 goes to the permanent grasslands – almost 21%, followed by the industrial crops – 19% and permanent crops (18%). Permanent grassland is a favourite organic category for the Bulgarian farmers, being also eligible for agri-environmental payments and less risky to convert into organic area. The share of permanent crops is due to the high demand for organically produced fruits. Of the areas occupied by industrial crops, the largest share belongs to those with aromatic and medicinal plants and spices - from 55 to 73% since 2015, which shows that they are attractive to organic producers - due to their demand and exporting value.

Furrow irrigation is the predominant practice in Bulgaria (Figure 3). The number of farms using dripping methods have increased slightly, but still represent just a share of 9% of all farms using irrigation in 2016. The sprinkler equipment is even low (3%).

Figure 3. Number of farms by type of irrigation systems



Source: National statistics of Ministry of Agriculture

Conclusion

Conventional tillage methods still exceed other more conservational options in Bulgaria. The use of manure as an organic fertilizer is negligible, but the rapid increase in the farms with organic production brings along good news for introducing organic fertilizers. Furrow irrigation still represents the dominant practice which is inefficient from economic point of view and can trigger environmental risks. As a whole, the level of provision of agri-environmental and organic practices is still insufficient and it will take many more years to catch up with the good examples in other European countries.

This paper is developed under national project "Sustainable multifunctional rural areas-rethinking agricultural models and systems with increased requirements and limited resources" (2017-2020), funded by the Bulgarian Science Fund.

Literature

1. Asadi, M.E.; Clemente, R.S.; Gupta, A.D.; Loof, R.; Hansen, G.K. (2002): *Impacts of fertigation via sprinkler irrigation on nitrate leaching and corn yield in an acid-sulphate soil in Thailand.* Agric. Water Manag, 52, 197–213.
2. Gathala MK, Ladha JK, Saharawat YS, Kumar V, Sharma PK (2011): *Effect of tillage and crop establishment methods on physical properties of a medium-textured soil under a seven-year rice-wheat rotation.* Soil Water management conservation. Soil Science Society of America Journal 75:851–1862.

3. Ge, S., Zhanling, Z., Yuanmao, J.. (2018): *Long-term impact of fertilization on soil pH and fertility in an apple production system.* Journal of soil science and plant nutrition, 18(1), 282-293.
4. Gu, S.; Hu, Q.; Cheng, Y.; Bai, L.; Liu, Z.; Xiao, W.; Gong, Z.; Wu, Y.; Feng, K.; Deng, Y.; (2019): *Application of organic fertilizer improves microbial community diversity and alters microbial network structure in tea (Camellia sinensis) plantation soils*. Soil Tillage Res. 2019, 195, 104-356
5. Guo LJ, Zhang ZS, Wang DD, Li CF, Cao CG (2015): *Effects of short-term conservation management practices on soil organic carbon fractions and microbial community composition under a rice-wheat rotation system*. Biology and Fertility of Soils 51:65–75.
6. Helgason BL, Walley FL, Germida JJ (2010): *Long-term no-till management affects microbial biomass but not community composition in Canadian prairie agroecosytems*. Soil Biology & Biochemistry 42:2192–2202.
7. Huang, P., Zhang, J., Zhu, A., Li, X., Ma, D., Xin, X., Zhang, C., Wu, S., Garland, G., Pereira, E., (2018): *Nitrate accumulation and leaching potential reduced by coupled water and nitrogen management in the Huang-Huai-Hai plain*. Sci. Total Environ. 2018, 610, 1020–1028
8. Kochakinezhad, H., Peyvast, G., Kashi, A-K., Olfati, J-A., and Asadi, A. (2012): *A comparison of organic and chemical fertilizers for tomato production. Journal* of Organic Systems, 7 (2), pp. 14-25
9. Korschens, M. (2006): *The importance of long-term field experiments for soil science and environmental research-a review.* Plant, Soil & Environment. 52, 1-8.
10. Leroy, B.L.M, Herath, H.M.S.K, Sleutel, S., De Neve, S., Gabriels, D., Reheul, D., Moens, M. (2008): *The quality of exogenous organic matter: short-term effects on soil physical properties and soil organic matter fractions.* Soil Use and Management. 24, 139-147.
11. Li, Y.; Wang, C.; Wang, T.; Liu, Y.; Jia, S.; Gao, Y.; Liu, S. (2020): *Effects of Different Fertilizer Treatments on Rhizosphere Soil Microbiome Composition and Functions.* Land 2020, 9, 329.
12. Liang, R., Hou, R., Li, J., Lyu, Y.; Hang, S.; Gong, H.; Ouyang, Z. (2020):*Effects of Different Fertilizers on Rhizosphere Bacterial Communities of Winter Wheat in the North China Plain*. Agronomy 2020, 10, 93.

13. Mathew RP, Yu CF, Githinji L, Githinji L, Ankumah R, Balkcom KS (2012): *Impact of no-tillage and conventional tillage systems on soil microbial communities.* Applied and Environmental Soil Science, vol. 2012, Article ID 548620, 10 pages.
14. Michael, A.M. (2008): *"Irrigation Theory and Practice", Second edition (revised and enlarged)* Vikas Publishing House PVT. Ltd, Delhi, India.
15. Prasad, R. (2009): *Efficient fertilizer use—The key to food security and better environment.* Journal of Tropical Agriculture, 47, 1–17.
16. Shi, Y., Ziadi, N., Hamel, C., Bilanger, G., Abdi, D., Lajeunesse, J., Lafond, J., Lalande, R., Shang, J. (2020): *Soil microbial biomass, activity and community structure as a_ected by mineral phosphorus fertilization in grasslands*. Appl. Soil Ecol. 146, 103-391.
17. Sofyan E. T., Sara, D.S., Machfud, Y., (2019): *The effect of organic and inorganic fertilizer applications on N, P-uptake, K-uptake and yield of sweet corn (Zea mays saccharata Sturt)* IOP Conf. Ser.: Earth Environ. Sci. 393 012-021.
18. Su, J.Q.; Xia, Y.; Yao, H.Y.; Li, Y.Y.; An, X.L.; Singh, B.K.; Zhang, T.; Zhu, Y.G. (2017): *Metagenomic assembly unravel microbial response to redox fluctuation in acid sulfate soil.* Soil Biol. Biochem. 105, 244–252.
19. Sutton, M. A., Oenema, O., Erisman, J. W., Leip, A., van Grinsven, H., & Winiwarter, W. (2011): *Too much of a good thing.* Nature, 472, 159–161.
20. Tagar, F. A. Chandio, I. A. Mari, B. Wagan, (2012): *Comparative Study of Drip and Furrow Irrigation Methods at Farmer's Field*. World Academy of Science, Engineering and Technology 69.
21. Todorova, K. (2019): *Factors affecting adoption behavior of farmers in Bulgaria - agri-environment public goods for flood risk management,* Journal of Central European Agriculture 20(4):1248-1258.
22. Ziting W., Lu Liu, Qing Ch., Xiaoxia W.,Yang L., Juan H., Yuncheng L., (2017): *Conservation tillage enhances the stability of the rhizosphere bacterial community responding to plant growth*, Agron. Sustain. Dev. 37: 44 DOI 10.1007/s13593-017-0454-6

BIOWASTE RECYCLING AS A SOLUTION TOWARDS A GREENER ECONOMY IN THE EUROPEAN UNION

Raluca Ignat[1], *Marius Constantin*[2]

Abstract

The European Commission aims at making Europe climate neutral in 2050 through a set of policies assumed in The European Green Deal. In view of this important goal, the main purpose of this research paper was to highlight how the European Union Member States have progressed towards becoming climate neutral, especially focusing on two key factors: the recycling rate of municipal waste and the amount of recycled bio-waste per capita. Based on the previously mentioned indicators, a cross-sectional econometric model was designed which indicates that 63.62% of the variation of the recycling rate of municipal waste is explained by the variation of the recycled bio-waste per capita. Therefore, in order to meet one of the targets of the Waste Framework Directive – reaching a recycling rate of municipal waste of 50% by 2020, the results of this study are meant to encourage recycling, as each contribution counts towards consolidating the desirable greener economy.

Key words: *recycling, waste, green economy, European Union.*

Introduction

The European policies regarding building a greener economy draw more attention than ever. It has been highlighted that they cannot exclude the link between the natural environment and agriculture, especially taking into account that the environmental policy objectives are integrated in the agricultural policies (Teodor, 2012). Moreover, the desirable greener economy implies focusing on climate change, yet another issue directly tied to agricultural practices and to the many actions of all the actors involved in the agri-food chain (Istudor et al., 2020; Andrei et al., 2019). In the transition from a consumption-based economy to a circular economy, agriculture must be approached while considering environment damage reduction, the use of pes-

1 Raluca Ignat, Ph.D., Associate Professor, Bucharest University of Economic Studies, Department of Agri-food and Environmental Economics, Mihail Moxa Street no. 5-7, district 1, 010961 Bucharest, Romania, E-mail: raluca.ignat@ase.ro

2 Marius Constantin, Ph.D. Student, Bucharest University of Economic Studies, Department of Agri-food and Environmental Economics, Mihail Moxa Street no. 5-7, district 1, 010961 Bucharest, Romania, E-mail: constantinmarius15@stud.ase.ro

ticides and other similar products (Ion, 2019), waste reduction (Negrei and Istudor, 2018) and other obstacles. Initiatives for a greener economy can also involve reducing the carbon footprint through small, yet economically-effective actions, which has to be looked upon through an educational perspective as well (Pătărlăgeanu et al., 2020).

The main purpose of this research paper was to contribute with an overview on how the European Union Member States progressed towards meeting one of the targets of the Waste Framework Directive (Directive 2008/98/EC on waste), more specifically that of achieving 50% recycling rate of municipal waste by 2020 in the case of all the European Union Member States. Additionally, in order to efficiently provide solutions to consolidate a greener economy in the European Union and to ensure sustainable development, another undertook objective was to identify the impact of the recycled biowaste on the recycling rate of municipal waste.

Materials and Methods

Taking the aim of this paper into consideration, the main materials needed in order to conduct this research refer to the indicators available in the Eurostat database: "recycling of biowaste per capita" (online data code: CEI_WM030) and "recycling rate of municipal waste" (online data code: CEI_WM011). Data were taken over from the Eurostat database at 1 September 2020 and were processed according to EViews requirements, a software product used in this research. EViews provides access to powerful statistical, forecasting, and modeling tools. "Recycling of biowaste per capita" represents the ratio of composted/methanised municipal waste over the total population and it is expressed in kilograms per capita. This indicator is part of the Circular Economy indicator set (COM/2020/98) and it is meant to monitor the progress made towards a circular economy via signaling the importance of composting as a contribution to circular economy objectives. Taking the transition to this new form of economy into account, biotic resources must be integrated in the economy or in the natural environment in any beneficial way. On top of that, biowaste is also important because it can also refer to the mix with other waste and landfilled, thus having implications in regard to contributing to the mitigation of climate change. "Recycling rate of municipal waste" represents another indicators part of the Circular Economy indicator set, as it provides a representation of how waste from the final consumers is used as a new resource in the economy, while also providing an essential indication of the quality of the overall waste management system.

Expressed in percentage, this indicator is meant to quantify the recycled municipal waste in the total municipal waste generation, annually.

The previously mentioned statistical data represent the fundation for the research method applied in this case – linear regression with cross-sectional data, therefore a quantitative research method specific to the field of econometrics (Park, 2015). This form of regression is designed to explain and quantify the relation between the two types of variables (dependent and independent) included in the model, while still focusing on the fact that all the all the variables refer only to one specific period in time. This kind of econometric models put the observations in the highlight, rather than focusing on the evolution in time of the variables (Karabiyik et al., 2019).

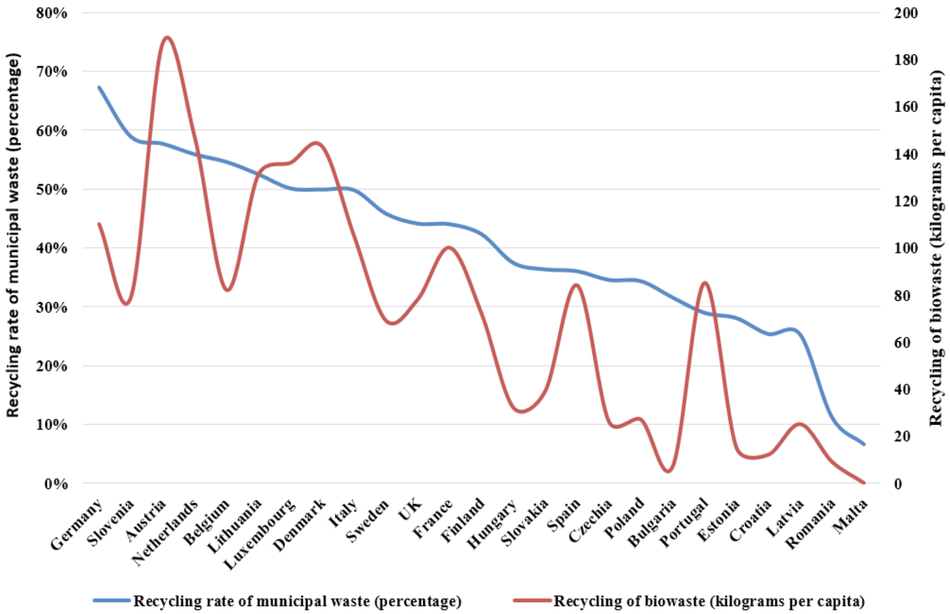
In this paper, the designed econometric model consists of the following: a dependent/endogenous variable: "the recycling rate of municipal waste" and an independent/exogenous variable: "recycling of biowaste per capita". Taking the characteristics of the cross-sectional data into account, the variables included in the model and the observations refer to the year 2018. This year was selected to be the point of reference for this research because it is the most recent year for which data is avaiable in the Eurostat database when taking over the previously mentioned indicators, as of 1 September 2020. Regarding the observations included in the analysis, they include all the 28 European Union Member States (2018), with three exceptions: Greece, Cyprus and Ireland. These countries were not included in the econometric model because data is not available in respect to these countries and to the variables of the cross-sectional linear regression model.

After conducting an initial statistic analysis, the construction of the econometric model went methodically through the stages of specification, setting the parameters, testing and validation. Estimating the parameters within the linear regression model was facilitated by the method of least squares. Afterwards, there were tests performed in order to ensure the validity of the model: the t–student test (H_0: the coefficients do not differ significantly from 0 and H_1: the coefficients are significantly different from 0), the Durbin–Watson test for autocorrelation of errors. Eventually, the White test was performed to define whether the residuals of the model are homoscedastic or heteroscedastic.

Findings

In 2018, the most competitive country in the European Union is Germany when referring to the degree of municipal waste recycling (67.3%), followed by Slovenia, Austria and the Netherlands.

Figure 1. The recycling of biowaste per capita (kilograms per capita) and the recycling rate of municipal waste (percentage), 2018.



Source**:** Authors' conceptualization based on Eurostat data

On the opposite side, Malta (6.5%), Romania, Latvia and Croatia encounter serious issues in terms of catching up to the average of the European Union (40.3%) when analyzing the recycling rate of municipal waste and to the target (50%) set by the Waste Framework Directive.

The descriptive statistics analysis of the two indicators included in the designed econometric model facilitates drafting overview on the analyzed countries in terms of their progress towards meeting the Waste Framework Directive target and, among others, becoming climate neutral. In 2018, on average, the recycling rate of municipal waste was 40.31% with a standard deviation of 14.76% (which represents 2,73 times the mean) – which indicates the European Union encounters significant discrepancies regarding the degree of recycling municipal waste: while almost 9 countries met the 50% recycling rate target by 2018, 16 countries are still working towards achieving this common objective (data is missing for the remaining three European Union Members: Greece, Cyprus and Ireland).

Table 1. Descriptive statistics (reference year: 2018)

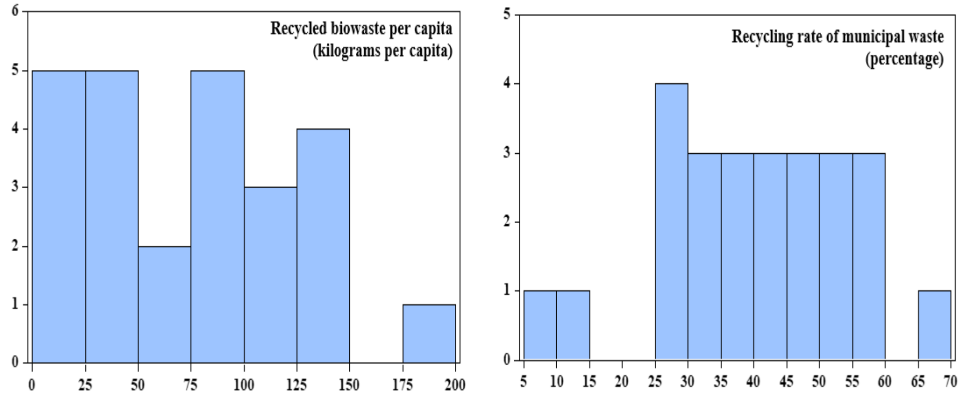
	Recycling rate of municipal waste (%)	Recycled biowaste per capita (kilograms per capita)
Mean	40.3160	72.0000
Median	42.3000	78.0000
Maximum	67.3000	187.0000
Minimum	6.5000	0.0000
Standard deviation	14.7684	51.8644
Skewness	-0.4264	0.3643
Kurtosis	2.8091	2.1953
Jarque–Berra	0.7956	1.2272

Source: Results extracted by authors from EViews based on Eurostat data

Regarding recycled biowaste per capita, the average was 72 kilograms per capita annually with a standard deviation of 51.86 kilograms per capita (which represents 0.72 times the mean), therefore consolidating the finding that the European Union encounters significant discrepancies regarding recycling. While Austria recycled the most biowaste in 2018 (187 kilograms per capita), followed by the Netherlands (147 kilograms per capita) and Denmark (143 kilograms per capita), on the other hand, Malta did not recycle biowaste. Unfortunately, Bulgaria and Romania recycled only 7 kilograms of biowaste, respectively 9.

With reference to the Skewness, Kurtosis and Jarque–Berra, the distribution of the recycling rate of municipal waste is characterized by having a left tail since the Skewness value is negative (-0.4264), a big part of the distribution is located on the right (Startz, 2019), therefore indicating a tendency of the analyzed countries to record values above the average, average which is still less than that of the target set in Waste Framework Directive. Moreover, the distribution of the same indicator is slightly platykurtic, due the Kurtosis value of 2.8091 – signaling that the distribution contains few and less extreme outliers than does the normal distribution (specific to a Kurtosis value of 3). However, preferably, the distribution of the recycling rate of municipal waste should be negatively asymmetric and deeply leptokurtic in order for all the European Union Member States to converge simultaneously towards meeting the objective of reaching the desirable recycling rate of municipal waste of 50% by 2020.

Figure 2. The histograms of the analyzed indicators (reference year: 2018)

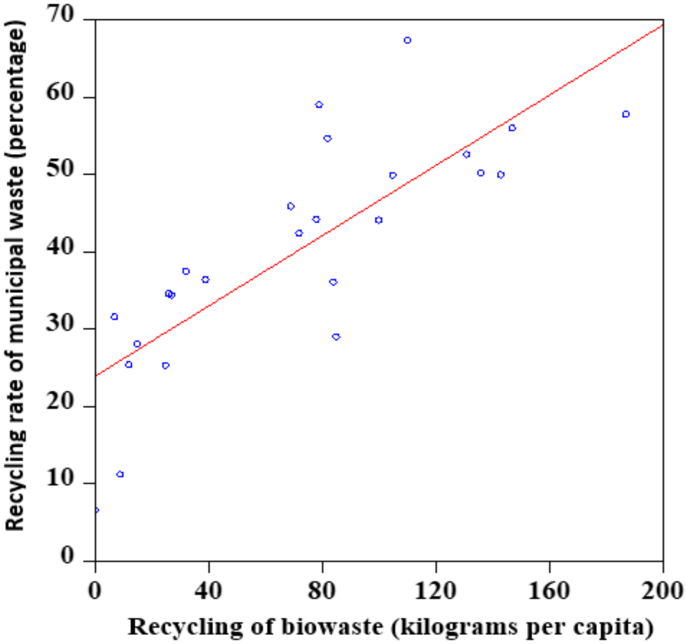


Source: Authors' work in EViews based on Eurostat data

Regarding the recycled biowaste per capita, its distribution is characterized by a slightly positive skew, especially if considering the long right tail and the fact that the distribution mass is concentrated towards the right of Figure 2 (based on the statistics included in Table 1; the value of Skewness is 0.3643). Additionally, the same distribution is platykurtic (Kurtosis: 2.1953) and not considered nomal from the perspective of the Jarque–Berra indicator (in this case 1.2272, while a normal distribution is considered when this value is close to zero). This distribution indicates that the majority of the European Union Member States converge towards recycling small quantities of biowaste.

Considering these initial findings, the econometric model constructed refers to identifying solutions for consolidating a greener economy in the European Union, while also referring to ensuring that the Waste Framework Directive target is met. The methodology was respected and the next research step was point plotting with respect to the selected indicators, in order to validate that the linear model is the one that fits the cross-sectional model the best. As observed in Figure 3, the econometric model can be successfully constructed as linear with the previously two indicators analyed. The correlation between the indicators is 79.76%.

Figure 3. Point plotting – validating the linear regression model



Source: Authors' conceptualization in EViews based on Eurostat data

The cross-section linear regression equation, with the coefficient of determination 63.62%, in the case of the analysed European countries (2018) explains that a quantity of 10 kilograms of recycled biowaste per capita annually triggers a recycling rate of municipal waste of 26.2334%, calculated: (23.9624 + (0.2271 × 10)). Taking into account that this rate must reach 50% by 2020 according to the targets assumed in the Waste Framework Directive and based on the designed econometric model, any European Union Member State should recycle at least 114.6525 kilograms per capita of biowaste, calculated: (23.9624 + (0.2271 × 114.6525)). This result suggests that from the average of 72 kilograms of recycled biowaste in 2018, the European Union must make efforts in order to increase this value to 114.6525 kilograms per capita of recycled biowaste by 2020 in order to reach the target of 50% recycling rate of municipal waste target assumed in the Waste Framework Directive.

Table 2. Regression model results

Dependent Variable: The recycling rate of municipal waste				
Method: Least Squares				
Included observations: 25				
Formula of the method				
LS "The recycling rate of municipal waste" C "Recycled biowaste per capita"				
Formula of the equation of the model				
The recycling rate of municipal waste = C(1) + C(2) × Recycled biowaste per capita				
Equation of the model and coefficients obtained				
The recycling rate of municipal waste = 23.9624 + 0.2271 × Recycled biowaste per capita				
Variable	**Coefficient**	**Std. Error**	**t–Statistic**	**Prob.**
C	23.9624	3.1558	7.5931	0.0000
Recycled biowaste per capita	0.2271	0.0358	6.3427	0.0000
R^2	0.6362	Mean dependent var	40.3160	
Adjusted R^2	0.6204	S.D. dependent var	14.7684	
S.E. of regression	9.0986	Akaike info criterion	7.3307	
Sum squared resid	1,904.0688	Schwarz criterion	7.4283	
Log likelihood	-89.6343	Hannan-Quinn criter.	7.3578	
F–statistic	40.2302	Durbin–Watson stat	2.0696	
Prob (F–statistic)	0.0000			

Source: Authors' calculations in EViews based on Eurostat data

The t–student parameter values are calculated in the t–Statistic column. If Prob. <0.05, H_0 is rejected: the parameters of the variables differ significantly from 0. Based on data from Tabel 2, the corresponding probabilities are in both cases less than 0.05 – therefore H_0 is rejected and H_1 accepted. The coefficients differ significantly from 0, therefore the model is valid from this perspective. The coefficient of determination (R^2) is characterized by a decent value. In 2018, in the analysed European countries, the recycling rate of municipal waste is explained in a proportion 63.62% by the exogenous variable, the recycled biowaste per capita. Should more variables be integrated in this econometric model, countering the mechanical increase of the coefficient of determination is supported by Adjusted R^2 (Gheorghiță and Pătărlăgeanu, 2006). This indicator consolidates the model's validity, considering that 62.04% (Adjusted R^2) is close to value corresponding to the coefficient of determination: 63.62%. Simultaneously, the model passes the error autocorrection test, according to the Durbin–Watson indicator, which quantifies the correlation between the errors of the model. The value should range around 2 in order for the errors not be correlated and for the linear regression model to be considered valid. In the case of the regression model constructed in this research paper, the Durbin–Watson value is 2.0696, a value which validates the model. Continuing, the model testing was followed by the White test performed on the residuals, which confirmed the desirable homoskedastic character – the errors do have a constant dispersion. This result is justified by the F–statistic 0.0592 and Prob.F 0.9427 (greater than the 0.05 threshold required in order to accept homoscedasticity). Moreover, the median of the residuals is very close to zero, consolidating furthermore the validity of the model.

Conclusions

The results of this research are meant to encourage recycling, as each contribution counts towards transitioning to the desirable green economy. In the European Union, achieving a recycling rate of municipal waste of 50% by the end of 2020 is certainly conditioned by closing the circle from waste to resource, especially by recycling biowaste. In this study, it was highlighted that, in 2018, there are discrepancies between the European Union Member States regarding the recycling rate and the amount of recycled biowaste, as some countries already met the target set by Waste Framework Directive, while others still need to reevaluate their strategies.

The limitations of this research involve the use of the cross-sectional statistical data, as the temporal point of reference for the econometric model was the year 2018. Not only can this research be extended by analyzing the evolution of the transition towards a greener economy in the European Union, but also one can extend this research by analyzing other countries, besides those that are part of the European Union. Moreover, this research can be extended by designing a new econometric model which could include other factors subject to recycling, other than the biowaste.

Literature

1. Andrei, J.V., Ion, R.A., Chivu, L., Pop, R.E. and Marin, A. (2019): Investigations on Farmers' Willingness to Associate and Join in Environmental Responsible Short Supply Chain in Romania. *Applied Ecology and Environmental Research*, 17(2), pp.1617–1639.

2. *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committe and the Committee of the Regions A new Circular Economy Action Plan for a Cleaner and More Competitive Europe*. 2020.
3. *Directive 2008/98/EC of the European Parliament and of the Council on waste*. Official Journal of the European Union. 2008.
4. Eurostat. Online Database. 2020
5. Gheorghiță, M. and Pătărlăgeanu, S.R. (2006): *Econometrie*.
6. Ion, R.A. (2019): Pesticides Use In Agriculture and Human Health in a Global Context: Evidence from Romania. *Sustainable Agriculture And Rural Development In Terms Of The Republic Of Serbia Strategic Goals Realization Within The Danube Region*, pp.701–715.
7. Istudor, N., Ion, R.A., Petrescu, I.E. and Hrebenciuc, A. (2019): Agriculture and the Twofold Relationship between Food Security and Climate Change. Evidence from Romania. *Amfiteatrul Economic*, 21(51), p.285.
8. Karabiyik, H., Palm, F.C. and Urbain, J.-P. (2019): *Econometric Analysis of Panel Data Models with Multifactor Error Structures*. Annual Review of Economics, 11(1), pp.495–522.
9. Negrei, C. and Istudor, N. (2018): Circular Economy – Between Theory and Practice. *Amfiteatrul Economic*, 20(48), p.498.
10. Park, H.M. (2015): *Linear regression models for panel data using SAS, Stata, LIMDEP, and SPSS*. Trustees of Indiana University.
11. Pătărlăgeanu, S.R., Negrei, C., Dinu, M. and Chiocaru, R. (2020): Reducing the Carbon Footprint of the Bucharest University of Economic Studies through Green Facades in an Economically Efficient Manner. *Sustainability*, 12(9), p.3779.
12. Startz, R. (2019): *EViews Illustrated*. University of California.
13. Teodor, C. (2012): Indicators for Integration of Environmental Concern Into the Agricultural Policy. *Economics of Agricultur*

CHINA-SERBIA AGRICULTURAL TRADE: PAST PERFORMANCES AND FUTURE EXPECTATIONS

Vasilii Erokhin[1]*, Gao Tianming*[2]

Abstract

Currently, China is one of the world's largest consumers of food, which makes a trade with China profitable for countries specializing in the production of various kinds of agricultural products. In the past few years, Serbia has managed to significantly increase the value of agricultural exports to China, although only in a few positions. This paper estimates the opportunities for more mutually beneficial involvement of both Serbia and China in agricultural trade with each other based on their comparative advantages. The use of Balassa's Revealed Comparative Advantage method allowed the author to identify mismatches between competitive positions and the current trade balance for certain categories of agricultural products. The study concludes with the identification of the categories of agricultural products for which the export from Serbia to China should be encouraged.

Key words: *agricultural trade, China, export, import, revealed comparative advantage, trade balance.*

Introduction

Trade in a wide range of food and agricultural products has been becoming more and more important for China in terms of ensuring stable food supply and food security for its world's largest population (Zhou, 2010; Tian et al., 2018). Eastern Europe in general and Serbia in particular have not been among the major trade partners for China compared to North America, Latin America, or Western Europe (Ella, 2018; Song, 2017). However, since recently, the importance for China of food and agricultural suppliers from the countries of Eastern Europe has been increasing (Erokhin, Gao, 2020). The increase has been associated with various factors, including progressing improvement of trade ties with Europe as part of the Belt and Road Initiative (Zhao, 2016), increasing living standards and purchasing power of Chinese people (Gao et al., 2018), changing consumption patterns in

1 Vasilii Erokhin, Ph.D., Associate Professor, School of Economics and Management, Harbin Engineering University, Nantong Street no. 145, 150001 Harbin, China, Phone: +86 156 3670 9072, E-mail: basilic@list.ru

2 Gao Tianming, Ph.D., Associate Professor, School of Economics and Management, Harbin Engineering University, Nantong Street no. 145, 150001 Harbin, China, Phone: +86 136 6461 9594, E-mail: gtmmail@163.com

China (Zhou et al., 2014), and a need for diversified sources of the food supply because of trade tensions with the USA (Varfalovskaya, 2018).

Despite the intensification of agricultural trade between China and Eastern Europe countries, this issue has been rather poorly addressed in the academic literature. For instance, Song (2017), Ella (2018), and Zhao (2016) studied the evolution of China-Europe economic and trade linkages, but not emphasized agricultural trade. A similar lack of attention to trade in agri-food products has been observed in a few China-Serbia studies. Van der Putten et al. (2016), Dimitrijević (2017), and Stojić Karanović and Jolović (2016) explored the economic cooperation between Eastern Europe, including Serbia, and China in the spheres of transport, energy, and information and communication technologies, but not agriculture. Pušić (2019) and Ivanić (2020) studied cooperation between Serbia and China in view of the implementation of the Belt and Road Initiative (BRI). Dimitrijević (2018, 2019) and Chen and Yang (2016) also revealed comparative advantages of China's investment in Serbia in the BRI's framework, but not addressed the agricultural sector.

In an attempt to bridge some of the gaps in China-Serbia studies, this paper aims to review the tendencies in agricultural trade between the two countries in the past decade and reveal the opportunities to better balance the benefits for both China and Serbia based on their comparative advantages in trade.

Materials and Methods

This study employs a four-stage approach to allow the author to analyze the preconditions of current agricultural trade between China and Serbia and estimate its development in the future. At Stage 1, China-Serbia agricultural trade is reviewed in retrospect (2010-2019) in terms of total values of bilateral imports, exports, trade turnover, and trade balance. At Stage 2, the author analyzes the structure of China-Serbia agricultural trade in 2019 in terms of the percentage of particular agricultural commodities in total exports and imports of food products. At Stage 3, changes in the trade balance of major categories of agricultural products are outlined from 2010 through 2019. Finally, at Stage 4, the revealed comparative advantage indexes are calculated for the two countries and seventeen categories of food and agricultural products traded between China and Serbia in past decade. The author uses the Balassa method (Balassa, 1965) of comparative advantage which explains trade patterns between China and Serbia by the relative differences of the two countries in productivity of their agricultural sectors (Equation 1):

$$RCA_{Ai} = \frac{\frac{x_{Ai}}{\sum_{j\in P} x_{Aj}}}{\frac{x_{Wi}}{\sum_{j\in P} x_{Wj}}} \qquad (1)$$

where:

RCA = revealed comparative advantage;
X = exports;
A = country;
W = world;
i = product;
P = set of products.

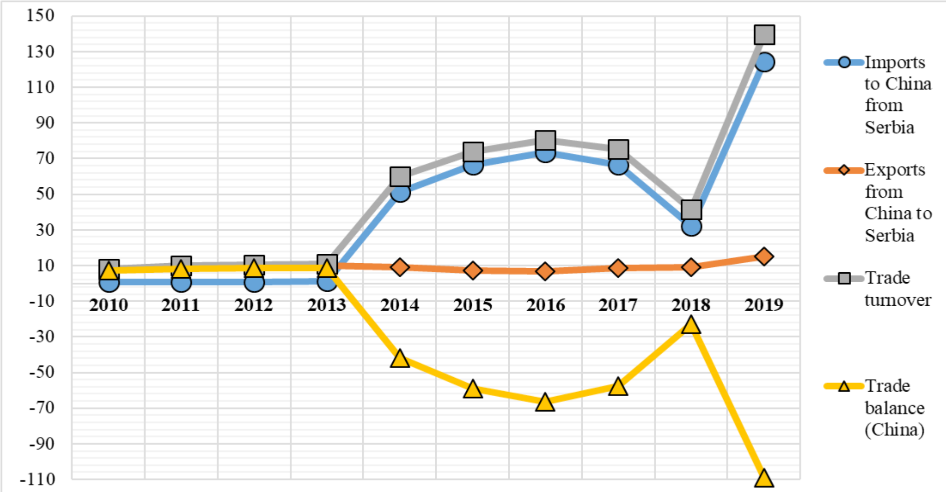
When $RCA \geq 1$, country *A* obtains a comparative advantage in trade in product *i*. $RCA<1$ shows the absence of comparative advantage or, in other words, it means that country *A* obtains a disadvantage in trade in product *i* (Erokhin et al., 2020). The study includes 16 categories of food and agricultural products (according to the SITC commodity classification) traded between China and Serbia in 2010-2019. UNCTAD's trade data are used (UNCTAD, 2020).

Results and Discussion

At Stage 1, agricultural trade between China and Serbia is analyzed in 2010-2019 by the parameters of imports, exports, trade turnover, and trade balance. Over the past decade, the value of agricultural trade between the two countries has grown significantly from $8.2 million in 2010 to $139.5 million in 2019. Especially rapid growth is observed after 2013 when China started purchasing tobacco and tobacco manufactures from Serbia. The increase in imports of tobacco caused a steadily negative balance for China in trade with Serbia – $108.9 million in 2019 (Figure 1).

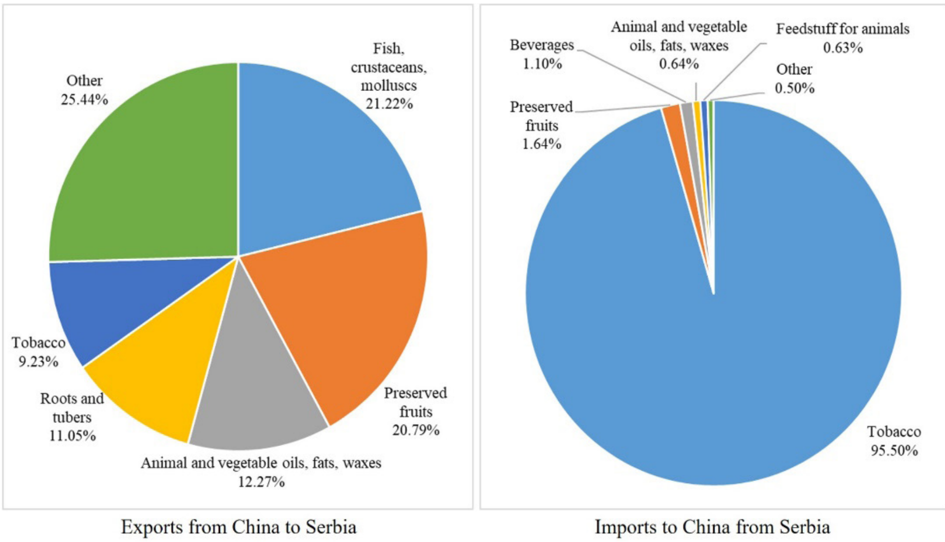
Tobacco and tobacco manufactures dominate in the imports from Serbia (95.5% in 2019). China also purchases preserved fruits and fruit preparations, alcoholic and non-alcoholic beverages, animal and vegetable oils, fats, and waxes, feedstuff for animals, fruit and vegetable juices, live animals, and chilled and frozen meat of bovine animals (Figure 2). The composition of Serbia's agricultural imports from China is more diversified compared to that of exports to China. Major categories of China's supplies to Serbia include chilled or frozen fish, prepared and preserved fish and aquatic invertebrates, preserved fruits and fruit preparations, animal and vegetable oils, fats, and waxes, prepared and preserved vegetables, roots, and tubers, unmanufactured tobacco and tobacco refuse, miscellaneous edible products and preparations, coffee, tea, and spices.

Figure 1. China-Serbia agricultural trade in 2010-2019, $ million.



Source: author's development based on UNCTAD (2020)

Figure 2. Structure of China-Serbia agricultural trade in 2019, the percentage of total exports and imports, top five products.



Source: author's development based on UNCTAD (2020)

Changes in the trade balance of selected categories of food and agricultural products traded between China and Serbia in 2010-2019 are outlined in Stage 3 of the study. As noted above, since 2014, the agricultural trade balance with Serbia has been negative for China, but the disparity has been decreasing in a number of positions. In particular, China has the most significant positive balance in trade with Serbia in fish, crustaceans, molluscs, and preparations thereof, prepared and preserved vegetables, roots, and tubers, preserved fruits and fruit preparations, miscellaneous edible products, crude animal and vegetable materials, and animal and vegetable oils, fats, waxes. The trade balance for manufactured tobacco, alcoholic beverages, feedstuff for animals, fruit and vegetable juices, and live animals is negative (Table 1).

Table 1. China-Serbia agricultural trade in 2010-2019, export, import, and trade balance by product, $ million

Products	2010			2015			2019		
	E*	I**	TB***	E*	I**	TB***	E*	I**	TB***
Live animals	0.00	0.02	-0.02	0.00	0.00	0.00	0.00	0.12	-0.12
Fish, crustaceans, molluscs	0.49	0.00	+0.49	1.13	0.00	+1.13	3.25	0.00	+3.25
Vegetables	1.11	0.00	+1.11	0.75	0.06	+0.69	0.45	0.00	+0.45
Roots and tubers	0.65	0.11	+0.54	1.13	0.05	+1.08	1.69	0.12	+1.57
Fruits and nuts	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	+0.36
Preserved fruits	2.94	0.34	+2.60	1.18	0.49	+0.69	3.18	2.04	+1.15
Juices	0.00	0.00	0.00	0.00	0.08	-0.08	0.00	0.14	-0.14
Sugar and honey	0.11	0.00	+0.11	0.04	0.00	+0.04	0.64	0.02	+0.62
Coffee, tea, spices	0.24	0.00	+0.24	0.22	0.00	+0.22	0.48	0.01	+0.47
Feedstuff for animals	0.06	0.00	+0.06	0.00	0.49	-0.49	0.08	0.78	-0.70
Edible products and preparations	0.11	0.00	+0.11	0.65	0.00	+0.65	1.15	0.02	+1.13
Beverages	0.00	0.04	-0.04	0.00	0.28	-0.28	0.00	1.36	-1.36
Tobacco	0.47	0.00	+0.47	0.01	64.97	-64.96	1.41	118.59	-117.18
Oil seeds and oleaginous fruits	0.90	0.00	+0.90	0.66	0.00	+0,66	0.70	0.00	+0.70
Crude animal and vegetable materials	0.01	0.00	+0.01	0.54	0.00	+0.54	1.13	0.00	+1.12
Animal and vegetable oils, fats, waxes	0.66	0.00	+0.66	1.60	0.00	+1,60	1.88	0.79	+1.09
Total	7.74	0.51	+7.22	7.37	66.44	-59.07	15.30	124.18	-108.88

Note: E* – exports from China to Serbia; I** – imports to China from Serbia; TB*** – trade balance (China)
Source: author's development based on UNCTAD (2020)

The calculation of the revealed comparative advantage for selected categories of food and agricultural products traded between China and Serbia (Stage 4) demonstrated the matches between the "advantageous" positions and values of export. Thus, Serbia enjoys a significant comparative advantage in trade in tobacco and tobacco manufactures, while China possesses an advantage in trade in vegetable roots and tubers and fish, crustaceans, and molluscs (Table 2).

Table 2. Revealed comparative advantage index in China and Serbia in 2010-2019, annual

Products	2010		2015		2019		Change, 2019 to 2010	
	China	Serbia	China	Serbia	China	Serbia	China	Serbia
Live animals	0.228	5.392	0.204	3.396	0.188	1.657	-0.040	-3.735
Fish, crustaceans, molluscs	1.080	0.018	0.922	0.061	0.897	0.143	-0.183	+0.125
Cereals	0.315	0.709	0.068	0.187	0.145	0.339	-0.170	-0.370
Vegetables	1.033	2.054	0.756	1.454	0.833	1.418	-0.200	-0.636
Roots and tubers	1.706	2.937	1.554	1.694	1.720	1.592	+0.014	-1.345
Fruits and nuts	0.314	2.193	0.349	2.478	0.382	1.764	+0.068	-0.429
Preserved fruits	1.393	27.189	0.962	22.588	1.122	14.923	-0.271	-12.266
Juices	0.599	3.800	0.327	2.795	0.379	2.973	-0.220	-0.827
Sugar and honey	0.703	1.688	0.679	0.907	0.765	0.878	+0.062	-0.810
Coffee, tea, spices	1.071	0.135	1.227	0.087	1.370	0.190	+0.299	+0.055
Feedstuff for animals	0.320	1.929	0.256	1.784	0.293	2.517	-0.027	+0.588
Edible products and preparations	0.388	2.313	0.353	1.983	0.378	1.790	-0.010	-0.523
Beverages	0.250	7.876	0.263	5.422	0.254	5.640	+0.004	-2.236
Tobacco	0.144	1.630	0.187	9.321	0.221	8.244	+0.365	+6.614
Oil seeds and oleaginous fruits	0.110	0.859	0.086	1.903	0.089	1.953	-0.021	+1.094
Crude animal and vegetable materials	0.509	1.075	0.555	0.777	0.496	0.978	-0.013	-0.097
Animal and vegetable oils, fats, waxes	0.116	1.084	0.120	0.811	0.224	0.509	+0.108	-0.575

Source: author's development based on UNCTAD (2020)

In general, out of all categories of agricultural products traded between the two countries, China obtains comparative advantages over Serbia in three positions only. Moreover, the value of China's RCA for fish, crustaceans, and molluscs has decreased since 2010. Serbia has also lost points in the RCA indexes for live animals, cereals, vegetables, fruits, crude animal and vegetable materials, animal and vegetable oils, fats, and waxes, and some other categories of agricultural products, for which Serbia is still possessing an advantage over China (Table 3).

Table 3. Relation and dynamics of the revealed comparative advantage index in China and Serbia in 2019.

Products	Relation		Dynamics	
	China	Serbia	China	Serbia
Live animals			↓	↓
Fish, crustaceans, molluscs			↓	↑
Cereals			↓	↓
Vegetables			↓	↓
Roots and tubers			↑	↓
Fruits and nuts			↑	↓
Preserved fruits			↓	↓
Juices			↓	↓
Sugar and honey			↑	↓
Coffee, tea, spices			↑	↑
Feedstuff for animals			↓	↑
Edible products and preparations			↓	↓
Beverages			↑	↓
Tobacco			↑	↑
Oil seeds and oleaginous fruits			↓	↑
Crude animal and vegetable materials			↓	↓
Animal and vegetable oils, fats, waxes			↑	↓

Note: green – RCA index is higher compared to that in the second country; red – RCA is lower compared to that in the second country; ↑ – RCA increased in 2010-2019; ↓ – RCA decreased in 2010-2019.
Source: author's development based on UNCTAD (2020)

In several categories, however, the comparative advantages identified in the study do not correspond to the current status of bilateral trade between China and Serbia and the current trade balance. In particular, Serbia supplies a negligible value of vegetables to China, while the RCA for this position is higher for Serbia than for China. At the same time, the trade balance in the "Vegetables" category for Serbia is negative even against the background of a decrease in the value of China's RCA. A similar situation is observed for fresh or dried fruits and nuts, preserved fruits, sugar, sugar preparations, and honey, miscellaneous edible products and preparations, oil seeds and oleaginous fruits, and crude animal and vegetable materials. For China, there are no such discrepancies between product categories with advantages over Serbia and the current trade balance. For fish, crustaceans, molluscs, and preparations thereof, prepared and preserved vegetables, roots, and tubers, and coffee, tea, cocoa, spices, and manufactures thereof trade balance is positive for China.

Conclusion

This study investigated major parameters of the trade in food and agricultural products between China and Serbia in the past decade. Based on the four-staged analysis, it is worthwhile to conclude that in 2010-2019, the value of agricultural trade between the two countries has grown tremendously. The trade turnover has increased by almost seventeen times, including by thirteen times within just six years from 2014. Since that year, the trade balance has remained negative for China. Serbia's agricultural exports to China are dominated by manufactured tobacco, while China supplies to Serbia various kinds of fish and aquatic products, preserved fruits and fruit preparations, animal and vegetable oils, fats, and waxes, and prepared and preserved vegetables, roots, and tubers. For most product categories, Serbia's RCA excesses that of China, but in some cases, the advantage does not result in a positive trade balance for Serbia. In many categories of food and agricultural products, where China does not possess an advantage over Serbia, the former still has a profit in trade by ensuring a positive trade balance and even improving comparative advantages. To gain full benefits from agricultural trade with China in the future, Serbia should encourage exports of those products, for which it enjoys the highest RCA against China, but which have been underscored in the past, for instance, preserved fruits and fruit preparations, vegetables, live animals, fresh and dried fruits and nuts, oil seeds and oleaginous fruits, and crude animal and vegetable materials.

Literature

1. Balassa, B. (1965): Trade Liberalization and Revealed Comparative Advantage. *The Manchester School, 33*, 99-123.
2. Chen, X., Yang, C. (2016): Serbian Industrial Competitiveness and China-Serbia Cooperation. In: Dimitrijević, D. (Ed.), *Danube and the New Silk Road,* Institute of International Politics and Economics, Belgrade, Serbia, pp. 289-307.
3. Dimitrijević, D. (2017): *Capacities for Development Serbia's Cooperation with China*. China-CEE Institute, Budapest, Hungary.
4. Dimitrijević, D. (2018): Achievements and Challenges for China Investments in Serbia. *Administrative Consulting, 6*, 88-101.
5. Dimitrijević, D. (2019): Serbia-China Comprehensive Strategic Partnership – The Foreign Policy Paradigm of the "New Silk Road". *Eurasian Integration: Economics, Law, Politics, 4*, 94-106.

6. Ella, D. (2018): China-Europe Relations: Opportunities and Risks. In: Rosner, Y. Kantor, A. (Eds.), *The European Union in Turbulent Times: Challenges, Trends, and Significance for Israel,* Institute for National Security Studies, Tel Aviv, Israel, pp. 81-89.
7. Erokhin, V., Gao, T. (2020): China's Agricultural Trade with Eastern Europe: A Focus on Food Security and Sustainable Development. In: Subic et al. (Eds.), *Sustainable Agriculture and Rural Development in Terms of the Republic of Serbia Strategic Goals Realization within the Danube Region – Science and Practice in the Service of Agriculture,* Institute of Agricultural Economics, Belgrade, Serbia, pp. 575-592.
8. Erokhin, V., Li, D., Du, P. (2020): Sustainability-Related Implications of Competitive Advantages in Agricultural Value Chains: Evidence from Central Asia – China Trade and Investment. *Sustainability, 12*(3), 1117. doi:10.3390/su12031117.
9. Gao, T., Ivolga, A., Erokhin, V. (2018): Sustainable Rural Development in Northern China: Caught in a Vice between Poverty, Urban Attractions, and Migration. *Sustainability*, *10*, 1467. doi:10.3390/su10051467.
10. Ivanić, V. (2020): *Managing the Cultural Distance between Serbia and China*. Cultural Due Diligence Institute, Novi Sad, Serbia.
11. Pušić, R. (2019): The New Silk Road: Cultural Cooperation Between Serbia and China. In: Cvetković, V. (Ed.), *The Belt and Road: Reality and Expectations: Serbia's Experience,* University of Belgrade, Serbia, pp. 163-172.
12. Song, W. (Ed.), (2017): *China's Relations with Central and Eastern Europe: From "Old Comrades" to New Partners*. Routledge, London, UK.
13. Stojić Karanović, E., Jolović, D. (2016): Danube's Contribution to the New Silk Road and the Position of Serbia. In: Dimitrijević, D. (Ed.), *Danube and the New Silk Road,* Institute of International Politics and Economics, Belgrade, Serbia, pp. 180-202.
14. Tian, G., Wang, C. H., Tian, K., Liu, Y. (2018): Food Consumption and Economic Development in Contemporary China. *Contemporary Chinese Political Economy and Strategic Relations: An International Journal, 4*(3), 1179-1206.
15. UNCTAD (2020): *Data Center*. United Nations Conference on Trade and Development (UNCTAD), Geneva, Switzerland, retrieved November 6, 2020, from https://unctadstat.unctad.org/EN/

16. Van der Putten, F. P., Seaman, J., Huotari, M., Ekman, A., Otero-Iglesias, M. (Eds.), (2016): *Europe and China's New Silk Roads.* Netherlands Institute of International Relations "Clingendael", Elcano Royal Institute, Mercator Institute for China Studies, French Institute of International Relations.
17. Varfalovskaya, R. (2018): Development of China's Foreign Trade in the Context of Globalization and "Trade Wars" of the USA. *Far Eastern Affairs, 6*, 85-91.
18. Zhao, M. (2016): The Belt and Road Initiative and Its Implications for China-Europe Relations. *The International Spectator, 51*(4), 1-10.
19. Zhou, Z. (2010): Achieving Food Security in China: Past Three Decades and Beyond. *China Agricultural Economic Review*, *3*, 251-275.
20. Zhou, Z., Liu, H., Cao, L., Tian, W., Wang, J. (2014): *Food Consumption in China: The Revolution Continues*. Edward Elgar Publishing, Cheltenham, UK.

THEMATIC PROCEEDING

SHARING ECONOMY PERSPECTIVES FOR A SUSTAINABLE AGRICULTURE AND TOURISM DEVELOPMENT

Alba Demneri Kruja[1], Geri Ruci[2]

Abstract

This research is focused on ways and risks of implementing sharing economy especially in Albania which represents a developing country, with agriculture dominating the economy and employing approximately 40% of the workforce. These collaborative platforms provide them with opportunities on setting-up technology-based enterprises without the need of high capital investments. The research proposes that even though there is a hesitation in post-communist countries on cooperatives, a democratic, transparent and efficient model of collaboration on arranging goods and services, they may explore the contingency while implementing the sharing economy platforms especially in agriculture and tourism sectors, simultaneously focusing on their feature innovations to match the market socio-economic challenges.

Key words: *collaborative economy, agriculture, tourism, sustainability, Albania.*

Introduction

Sharing economy marketplaces have become cross-cultural phenomenon as these platforms have come up as a necessity to satisfy customer needs through digital platforms rather than evolving as a government economic strategy and is grounded on accessing instead of owning the required physical and human assets like time, space and skills (Botsman & Rogers, 2010a; Kim, Yoon & Zo, 2015). Sharing economy platforms have been evolved in early 2008 (Olalla & Crespo, 2019; Slee, 2018) and till then have brought some significant socio-economic benefits to developed nations precisely in those branches of economy such as "on-demand household service, on-demand professional service, p2p transportation" (Vaughan & Daverio, 2016) that underdeveloped markets lack in prosperity and that is the reason why Albania must be more focus oriented towards new ways of developing their economies with less costly alternatives by having lower transaction costs.

1 Alba Demneri Kruja, Ph.D., Lecture Professor, Epoka University, Rr. Tirane-Rinas km 12, Tirana, Albania, Phone: +355 4 22 32 086, E-mail: akruja@epoka.edu.al

2 Geri Ruci, Research Assistant, Epoka University, Rr. Tirane-Rinas km 12, Tirana, Albania, Phone: +355 4 22 32 086, E-mail: gruci16@epoka.edu.al

This research is focused on ways and risks of implementing sharing economy specifically in Albania which represents a developing country, one of Europe's poorest countries, with agriculture which dominates the economy and employs a about 40% percentage of the workforce, large informality that characterizes the way of doing business and government integrity remains always a concern (Kruja, 2013a; Gecaj, et al., 2018; Miller, et al., 2019; Kruja, 2020a). Doing business (2019) report ranks Albania in 63rd place out of 190 countries and point out that the government must pay serious attention to the topic of "paying taxes" (122/190). Whereas, Transparency International (2018) ranks Albania in 99th place out of 180 countries by scoring only 36 points out of 100 in corruption index that is the perception of experts and businesspeople for corruption level in public sector. All of these elements make it tough for certain actors along with their struggling efforts to make the leap to a potential economic growth and on the other hand governments circulate and apply strategies that are not implemented in the right way. In addition to that, businesses have not achieved to succeed due to harsh start up environment, high cost of setting up traditional business models and an unfair competition in the market which in contrary sharing economy is there to regulate the environment by incorporating together notions like digital platforms, trust and cooperatives. Scholars point out that by implementing collaborative platforms it is achieved increase of employment, resource usage effectiveness and efficiency as well as fair pricing and competitiveness (Stahel, 2010; Hysa et al., 2020).

This research attempts to develop a framework on the immediate need of Albania to create a public awareness campaign and formulate the proper legal regulations appropriate to have a smooth sharing economy administration, covering not only the government and its agencies but as well as media, civil society, businesses that must create a friendly environment. Policy makers can either facilitate or constrict the process by enacting a regulative climate, increasing their authority and proper implementation of their policies as well as boosting entrepreneurship (Xheneti & Smallbone 2008; Kruja, 2020b).

In addition to the illustration of current state of the country, the study examines further issues that shape the challenges of evolving sharing economy in Albanian context by defining: (1) the sectors of economy where strategy makers and platform developers must be concentrated on to create the proper infrastructure; (2) the appropriate cooperativism model that Albania must welcome in order to achieve sustainable development. Cooperatives in post-communist countries that is the case of Albania (that in most cases fall in the basket of developing countries) is a trustless model for community to participate on because remind them the communist regime. In this topic will be discussed further whether it is more valuable to have more access to the goods or services rather than just having an ownership title.

Study background

Sharing economy's core operations are built throughout the philosophy of sharing that has been crucial for humanity continuity (Belk 2014; Albinsson & Perera, 2018) that includes not only transactional activities but also, unconditional gifts and charity as an ethical and moral act. Correlation that occurs between individuals with different needs and explaining the reasons that makes them share their assets, is a focal point to pay attention when studying the human economic behavior and at the same time-sharing economy.

Moreover, sharing has not existed only as an ordinary need of neighbors to exchange goods and services with one-another. Establishment of cooperatives, used as one of the mechanisms to share resources, brought to the community the possibility to satisfy the community needs and have access to affordable and quality goods and services.

Market ecosystems are currently experiencing a metamorphosis that have a direct impact on the way economic actors are interacting in the marketplace. Sharing economy, the leading term of what is propagating to have disrupted economic sectors in developed countries and possibility to boost economic growth in developing countries (Sundararajan, 2016; Albinsson & Perera, 2018; Hysa, et al., 2020).

Different authors have used different terms and definitions to describe Sharing Economy such as Collaborative Economy, Collaborative Consumption, Peer to Peer Consumption and there are about 17 terms reported in the genealogic investigations conducted by Dredge & Gyimóthy (2015). Botsman (2014) uses the Collaborative Economy term and defines it as "a system activating the untapped value of assets through models and marketplaces that enable greater efficiency and access" (p.24). Meanwhile, the Collaborative Lifestyle is described by Botsman & Rogers (2010b) as "people with similar interests banding together to share and exchange fewer tangible assets such as time, space, skills, and money" (p. 73). Scholars have considered sharing economy as one of the "alternative forms of economic exchange" (Widlok, 2017) which could bring market growth after the financial crisis in 2008 by emphasizing access over ownership and focus on "cooperative rather than competitive market behavior" (Widlok, 2017; Shmidt, 2017). Other authors emphasize that the company only owns the infrastructure build by them and modeling a rating apparatus which will grow trust in marketplace (Como, et al., 2016). These platforms made possible creation of communities in the marketplace without knowing each-other but accessing and sharing resources between them that led to an easier usage of capacity (Sundararajan, 2016).

Perspectives of a post-communist country

Cooperatives are part of sharing economy platforms or better saying are among the main components when designing a sharing economy organization structure. Cooperatives are an evolutionary community organization system because of their ownership model. In Albania a former communist country, there exists a negative public perception for cooperatives as they were a communist model. The same perception is observed as well in other post-communist countries. These societies nowadays see themselves associated more with "private ownership" model than "sharing or direct exchange with other citizens" (Como, et al., 2016).

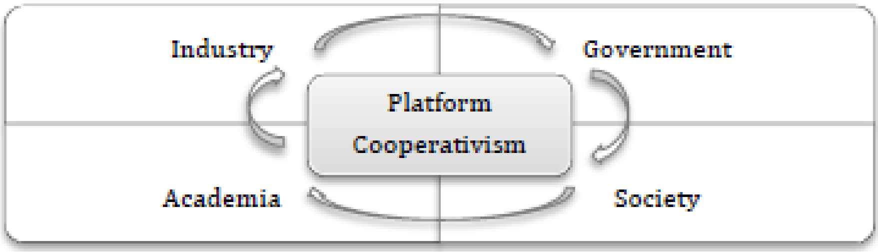
Albania would be right to put into practice the idea of "Platform Cooperativism" established by Scholz (2014), who suggested platforms to be dominated by their users and to be established in the form of a cooperative to provide solution to the majority of control and social responsibility concerns. The benefits come from members of cooperative would gain shared ownership to the value produced, as well as platforms could enforce the connection among workers.

The traditional way of developing relationships, as a result bring 'resource losses due to lack of information' (Allen & Berg, 2014) for both individuals and firms. Micro-entrepreneurial businesses (on-demand household service, on-demand professional service, P2P Transportation) in Albania have a great potential to grow their businesses by designing online platforms where providers of services and customers could meet and share knowledge with each other and where companies could target the appropriate market segment. Sharing economy have disrupted the traditional marketplace costs by reducing sacrifices in the relationship that consist of the transaction costs economies. The sharing economy is associated with discussions that draw attention to the problem of knowledge usage and price mechanism as market institution for the coordination of knowledge (Hayek, 1945), the role that sharing economy is playing today by decreasing the transaction costs, extending the market and allowing access to underused assets.

Albanian economy has enabled an inconsiderable space for new industries to evolve or for existing ones to innovate. Sharing economy function to an extent as a platform where could occur the process of creative destruction describing the "creation of a new industry or method of doing things destroys the industry or process that preceded it" or just achieve destruction of old practices and not of old products and services. Agriculture and tourism are key sectors of the Albanian economy, given the natural resource owned by the country and geographic position (Bernet & Kazazi, 2012; Ferizi & Kruja, 2018; Kruja, 2020b). There is happening a trust shift in the way that people trust more sharing economy platforms than government institutions and services. This phenomenon generates the idea and the question whether sharing economy platforms can get more responsibility in Albanian institutions, in sectors that till now have been operated by the state. Governments are systems that carry on and manage the resources of the country. So, the question that arises naturally has to do with the debate whether there exists or not the risk of these governments to build unlawful connections with some of the sharing economy platforms and establish a monopolistic/oligopolistic nature (Scholtz, 2014) with a false display of the free market which than raises the other question regarding if it's worthy welcoming sharing economy or it is a risky business and the effect will not be significant.

As sharing economy is perceived as a provider of real opportunities for micro-entrepreneurial businesses to increase their business capabilities and looking at the economic perspective, in the figure 1 below is provided a framework for an establishment of platform collaborativsm in Albania, but not only. Knowledge is crucial to the development of innovation systems and universities, governmental institutions as well as innovative enterprises are key components of this system (Kruja, 2013b). Beside the triple helix spiral collaboration model of Etkowitz & Leydersdorf (1995), a fourth helix of collaboration recognized as "media-based and the culture-based public" is extended by emphasizing that "culture and values, and the way how 'public reality' is being constructed and communicated by the media, influence every national innovation system" (Carayannis & Campbell, 2009). As determined by the Quadruple Helix model a synergic collaboration between the system stakeholders, industry-academia-government-society is decisive. According to Yun & Liu (2019) this type of collaborations are central for a sustainable knowledge on bringing up open innovation micro- and macro-dynamics.

Figure 1. A Framework for Platform Cooperativism Establishments in Albania.



Source: authors' research

Conclusions

Underdeveloped countries face difficulties to keep updated with innovative economic models that are growing in developed nations. The main reason why it has occurred is in a considerable rate delegated to the government capacity to have a clear strategy to support these initiatives but also media, as the law states, have to be informative and educative toward the public related to these radical changes in the market worldwide. Having said that, the discussion in Albania is raised in two levels. Firstly, society must be aware of these new models and then debating about technical and administrative issues. This research has been dealing with and arguing the second level of discussion by considering the first, a government and media will even though the paper suggests that it is stimulation for Albanian institutions, to take into consideration the role of sharing economy our market.

This study aimed to give answers to some questions that describe the opportunities and risks associated with the implementation of collaborative economy platforms in Albania and suggesting focus and adapt new economic models in the marketplace.

The research proposes that even though there exists a high hesitation in post-communist countries on cooperatives, by representing a democratic, transparent and efficient model of collaboration on arranging goods and services they may explore the contingency while implementing the sharing economy platforms, especially meanwhile focusing on their feature innovations to match market socio-economic challenges. The study has also a modest purpose to stimulate initiatives focusing in this area by bringing forward efficient ways on the development of these platforms by the quadruple helix collaboration among Industry-Government-Academia-Society.

Literature

1. Albinsson, P. A., & Perera, B. Y. (2018): The Rise of the Sharing Economy: Exploring the Challenges and Opportunities of Collaborative Consumption. ABC-Clio.
2. Allen, D., & Berg, C. (2014): The sharing economy: How over-regulation could destroy an economic revolution. From Institute of Public Affairs: https://www.parliament.vic.gov.au/images/stories/committees/SCEI/Ride_Sourcing/Submissions/Submission_145_-_Institute_of_Public_Affairs_Attachment_1.pdf
3. Belk, R. (2014): Sharing versus Pseudo-Sharing in Web 2.0. The Anthropologist 18 (1): 7–23.
4. Bernet, T. & Kazazi, I. (2012): Organic Agriculture in Albania - Sector Study 2011, Tirana: Swiss Coordination Office in Albania (SCO-A), Research Institute of Organic Agriculture (FiBL) & Ministry of Agriculture, Food, and Consumer Protection of Albania (MoAFCP):
5. Botsman, R. (2014): Sharing is not just for startups. Harvard Business Review. 92 (3), (pp. 23-26).
6. Botsman, R. & Rogers, R. (2010a): What's Mine Is Yours: The Rise of Collaborative Consumption. New York: Harper- Collins.
7. Botsman, R., & Rogers, R. (2010b): Beyond zipcar: Collaborative consumption. Harvard business review, 88(10), 30.
8. Carayannis, E.G. & Campbell, D.F.J. (2009): 'Mode 3' and 'Quadruple Helix': Toward a 21st century fractal innovation ecosystem. Int. J. Techn. Manag., 46, (pp. 201–234).
9. Como, E., Mathis, A., Tognetti, M., & Andrea Rapisardi. (2016): Cooperative Platforms in a European Landscape: An Exploratory Study. From Cooperatives Europe: https://coopseurope.coop/sites/default/files/Paper_Cooperatives%20Collab%20Economy__0.pdf
10. Dredge, D. & Gyimóthy, S. (2015): The collaborative economy and tourism: Critical perspectives, questionable claims and silenced voices, Tourism Recreation Research (pp. 286-302), DOI: 10.1080/02508281.2015.1086076
11. Etkowitz, H.; Leydersdorf, L. (1995): The Triple Helix of University-Industry-Government Relations: A Laboratory for Knowledge Based Economic Development. EASST review, 14(1), (pp. 14–19).

12. Ferizi, V., & Kruja, A. D. (2018): Coastline hospitality industry performance, challenges, and opportunities: evidence from Durres coastline. In Managing Sustainable Tourism Resources (pp. 14-38). IGI Global.
13. Gecaj, M.; Shahu, E. O.; Imami, D.; Skreli, E.; Jambor, A. (2018): Analysing the impact of subsidies in the Albanian agriculture sector–A comparative approach. Budapest, EAAE.
14. Hayek, F. (1945): The Use of Knowledge in Society. The American Economic Review 35(4), 520
15. Hysa, E., Kruja, A., Rehman, N.U., Laurenti, R. (2020): Circular Economy Innovation and Environmental Sustainability Impact on Economic Growth: An Integrated Model for Sustainable Development. Sustainability, 12, 4831.
16. Kim, J.; Yoon, Y.; and Zo, H., "Why People Participate in the Sharing Economy: A Social Exchange Perspective" (2015): PACIS 2015 Proceedings. 76. http://aisel.aisnet.org/pacis2015/76
17. Kruja, A. (2013): The contribution of SMEs to the economic growth (Case of Albania). EuroEconomica, 32(1), pp. 55-67.
18. Kruja, A. (2013b): Entrepreneurship and knowledge-based economies. Revista Românească pentru Educație Multidimensională, (1), (pp. 7-17).
19. Kruja, A.D. (2020a): Entrepreneurial orientation, synergy and firm performance in the agribusiness context: an emerging market economy perspective. Central European Business Review, 2020(1), 56-75.
20. Kruja, A.D. (2020b): Entrepreneurial challenges of Albanian agribusinesses: A content analysis. Journal of Eastern European Management Studies, 25(3), 531-555.
21. Miller, T., Kim, A. B., Roberts, J. M., & Patrick Tyrrell. (2019): *2019 Index of Economic Freedom.* From The heritage Foundation: https://www.heritage.org/index/pdf/2019/book/index_2019.pdf
22. Olalla, D. M., & Crespo, E. (2019): *Does the sharing economy truly know how to share?* From World Economic Forum: https://www.weforum.org/agenda/2019/01/does-the-sharing-economy-truly-know-how-to-share/
23. Scholz, T. (2014): Platform cooperativism vs the sharing economy. Retrieved from Medium: https://medium.com/@trebors/platform-cooperativism-vs-the-sharingeconomy-2ea737f1b5ad#.8dwxycjdx

24. Shmidt, M. (2017): People Who Care, Share. Book Review: Widlok T (2017) Anthropology and the Economy of Sharing, Abingdon, Oxon; New York: Routledge. P. 218. Journal of Economic Sociology = Ekonomicheskaya sotsiologiya, vol. 18, no 5, pp. 159–167. doi: 10.17323/1726-3247-2017-5-159-166
25. Slee, T. (2018): *The Rise and Fall of the Sharing Economy.* From Ernst Schmidheiny Foundation: https://www.esst.ch/getattachment/e44fdd6a-7be8-47e6-bb73-962676fc6592/Tom-Slee.aspx
26. Stahel, W. (2010): The Performance Economy; Palgrave Macmillan: Basingstroke, UK.
27. Sundararajan, A. (2016): The Sharing Economy The End of Employment and the Rise of Crowd-Based Capitalism. London: The MIT Press.
28. Yun, J.J. & Liu, Z. (2019): Micro- and Macro-Dynamics of Open Innovation with a Quadruple-Helix Model. Sustainability, 11, (p. 3301).
29. Vaughan, R., & Daverio, R. (2016): *Assessing the size and presence of the collaborative economy in Europe.* PWC.
30. Xheneti, M. & Smallbone, D. (2008): The Role of Public Policy in Entrepreneurship Development in Post-Socialist Countries: A Comparison of Albania and Estonia. EBS Review, Issue 24, pp. 23-36.
31. Widlok, T. (2017): Anthropology and the Economy of Sharing, Abingdon, Oxon; New York: Routledge

STUDY ON THE SCOPE AND POTENTIAL OF ECOLOGICAL AND CONVENTIONAL SURFACES IN ROMANIA

Alexandra Marina Brătulescu[1], *Ionut Laurentiu Petre*[2], *Daniela Nicoleta Voicilă*[3], *Alina Mărcuță*[4]

Abstract

The present study aims to analyze comparatively the cultivated areas in conventional and ecological system, in order to determine their share of the agricultural area of Romania, in the period 2014-2019, in the eight development regions. From this research hypothesis, it is intended to carry out a preliminary study, in order to identify the size of available areas, to be converted to organic farming, in the context of the new CAP.

Key words: *conventional and ecological, research, surfaces.*

Introduction

Organic farming is defined as a system in which products are made that support the health of people, ecosystems and resources. Compared to conventional systems, where inputs can have adverse effects, organic farming is based on biodiversity, clean environmental systems and life and product cycles based on zonal conditions.

Unlike organic farming, the classic one, in the conventional system, is described by its intensity, respectively by high doses of chemicals and intensive mechanization works, but these measures lead to obtaining competitive agricultural products on the market. The main character of this system is to be based on the concentration and specialization of production.

1 Alexandra Marina Bratulescu, Ph.D. candidate, Research Institute for the Economy of Agriculture and Development (ICEADR), district 1, 61 Marasti Blvd, 011464 Bucharest, Romania, E-mail: bratulescu.alexandra@iceadr.ro

2 Iounut Laurentiu Petre, Ph.D., Researcher Associate, Research Institute for the Economy of Agriculture and Development (ICEADR), district 1, 61 Marasti Blvd, 011464 Bucharest, Romania, E-mail: petre.ionut@iceadr.ro

3 Daniela Nicoleta Voicila, Ph.D. candidate, Research Institute for the Economy of Agriculture and Development (ICEADR), district 1, 61 Marasti Blvd, 011464 Bucharest, Romania, E-mail: badan.daniela@iceadr.ro

4 Alina Marcuta, Ph.D., Associate Professor, University of Agronomic Sciences and Veterinary Medicine of Bucharest, district 1, 59 Marasti Blvd, Bucharest, Romania, E-mail: alinamarcuta@yahoo.com

The term organic farming is designed similarly, depending on the legislation, with that of ecological or biological farming, and is a new process of raising animals or cultivating plants and thus obtaining agri-food products, which is essentially different from the classic one (conventional).

Although the yield is lower in the ecological system, it contributes to the development of economic activities, especially those with added value, while also contributing to the interest of the population towards the potential of rural areas.

The concept of organic farming is presented, quite suggestively in the following image, taken from the same source (Willem Hoogendijk, 1991) as the previous one, which suggests a slower but safer pace of production growth and another way of settling. and the role of the structural components - the reins of production in the hands of producers, a human society equally responsible and vigilant in maintaining a clean environment and food safety and food quality, and complex and comprehensive financial support.

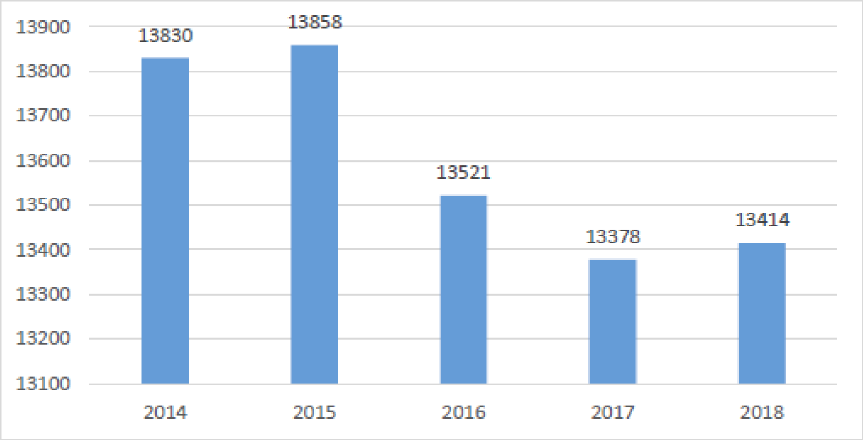
Materials and methods

The present study aims to determine the share of agricultural areas that are cultivated in a conventional and ecological system, as well as to establish the potential that Romania can have in practicing environmentally friendly agriculture, in accordance with future regulations of the CAP. In this regard, qualitative and quantitative data will be analyzed, taken from the international (Faostat), European (Eurostat) and national (INS) data bases on agricultural area, ecological area and areas where fertilizers and pesticides have been administered, to determine their share in the total agricultural area. Finally, with the help of data processing software, a forecast of these areas will be made to estimate whether Romania can align with the new CAP regulations that take into account a certain predetermined percentage (25%) of the area to be included in organic farming.

Results and discussions

In order to determine the share of agricultural areas cultivated in a conventional and ecological system, first the total extent of agricultural areas will be analyzed, and then conventional areas will be considered according to the area where fertilizers or pesticides were applied, and the ecological area will be found in European databases.

Figure 1. Agricultural area of Romania, 2014-2018 (thousand hectares)



Source: processing based on FAOSTAT

In Romania, in the period 2014-2018, it can be observed that the general trend of the agricultural area is a decreasing one. If in 2014 there were about 13.8 million hectares of agricultural land, in 2018, the agricultural area had an area of 13.4 million hectares, thus, there is a decrease in the analyzed period of 3%. On average over the period, there is an average agricultural area of 13.6 million hectares.

In order to be able to estimate a minimum area on which agriculture is practiced in a conventional system, a series of indicators were taken into account, such as: areas on which fertilizers are administered, areas on which herbicides, fungicides and insecticides are administered. Table 1 shows the agricultural areas that have been fertilized with chemical fertilizers in the eight development regions.

Table 1. Area on which chemical fertilizers were applied, 2014-2019.

Macroregions, development regions and counties	Year 2014	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019
	CHEMICAL					
	Hectares	Hectares	Hectares	Hectares	Hectares	Hectares
TOTAL	6 676 089	6 574 741	6 491 498	7 272 565	6 927 578	7 373 689
Northwest region	727 191	722 889	787 801	657 121	496 784	749 436
Central region	558 330	544 261	574 835	583 974	659 312	582 491
Northeast region	679 498	650 326	634 043	627 923	797 725	1 137 183
Southeast region	1 305 513	1 316 037	1 011 995	1 419 223	1 164 447	1 004 704
South Muntenia region	1 579 249	1 448 022	1 711 510	1 920 106	1 703 254	1 613 462
Bucharest Ilfov region	51 505	57 465	43 784	48 584	49 322	52 554
Southwest Oltenia region	892 610	972 387	839 511	964 164	959 780	981 823

Source: processing based on NIS data

In the period 2014-2019, the areas on which fertilizers were administered increased, which may lead to the idea that agriculture in Romania has experienced a greater degree of intensification. If in 2014 there were 6.67 million hectares fertilized, in 2019 the area fertilized with chemical fertilizers was spread over 7.37 million hectares, representing an increase of about 10.5%. Analyzing by development regions, the largest contribution to this increase has the North-East region, and the region that decreases the average is the South-East region, where there is a decrease in areas fertilized with chemical fertilizers.

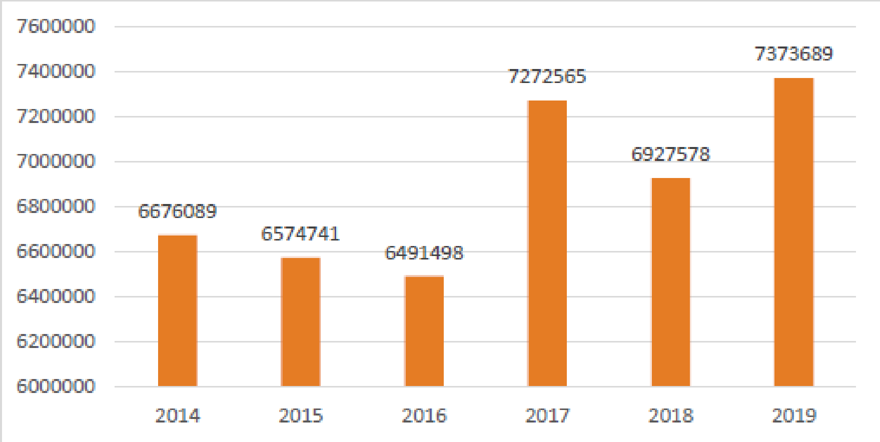
Table 2. Statistical indicators on the area with chemical fertilizers (hectares)

	N	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*
TOTAL	6	6 491 498,00	7 373 689,00	6 886 026,6667	370 291,34658
Central	6	544 261,00	659 312,00	583 867,1667	39 990,50757
Northeast	6	627 923,00	1 137 183,00	754 449,6667	197 648,07713
Southeast	6	1 004 704,00	1 419 223,00	1 203 653,1667	171 654,68357
South Muntenia	6	1 448 022,00	1 920 106,00	1 662 600,5000	158 593,77427
Southwest	6	839 511,00	981 823,00	935 045,8333	56 515,16082
Weast	6	863 354,00	1 252 036,00	1 005 671,0000	155 221,63882
Northwest	6	496 784,00	787 801,00	690 203,6667	103 899,69482
Bucharest Ilfov	6	43 784,00	57 465,00	50 535,6667	4 558,41923

Source: processing with SPSS.

Analysing the basic statistical indicators for the data in Table 1, the following can be stated: the total area of Romania where chemical fertilizers were administered, varied in the analysed period, between 6.49 million ha and 7.37 million ha. On average, the area fertilized with chemical fertilizers was 6.88 million hectares, from this average there is a standard deviation of 370 thousand ha which determines a coefficient of variation of 5.4%. Analysing by development regions, the coefficient of variation of the areas fertilized with chemical fertilizers varied depending on the region between 6 and 26%.

Figure 2. The surface on which chemical fertilizers were administered (ha)



Source: processing based on NIS data

It can be seen that the extent of the areas fertilized with chemical fertilizers oscillated, during the analysed period, in the first three years there was a decrease and then a sudden increase, however, the general trend is increasing, throughout the period there was a average growth rate of 2% per year.

Analysing the areas on which pesticides were administered, respectively the areas with each of the three product groups that are included in this category, and conducting the meeting of areas it was determined that the maximum area of the three categories of plant protection products is that - administered herbicides, these being the most used in Romanian agriculture. Thus, for the conventional land cultivation system and the areas on which herbicides were administered were taken into account.

Table 3. The surface on which herbicides were administered

Macroregions, development regions and counties	Year 2014	Year 2015	Year 2016	Year 2017	Year 2018	Year 2019
	HERBICIDES					
	Hectares	Hectares	Hectares	Hectares	Hectares	Hectares
TOTAL	3 583 839	3 476 103	3 474 815	3 605 714	3 304 749	3 778 820
Northwest region	433 558	352 844	311 969	203 290	214 026	347 869
Central region	211 158	177 414	226 124	204 500	175 887	221 269
Northeast region	392 637	448 169	384 330	425 089	485 870	553 801
Southeast region	617 202	679 973	674 092	734 019	643 440	663 290
South Muntenia region	898 606	856 443	954 049	1 008 926	850 803	984 755
Bucharest Ilfov region	30 868	31 002	38 724	38 542	23 788	41 728
Southwest Oltenia region	461 341	388 934	342 957	503 843	416 050	464 881

Source: processing based on NIS data

During 2014-2019, the areas where herbicides were administered increased, which may also lead to the idea that agriculture in Romania has experienced a greater degree of intensification. If in 2014 there were 3.58 million hectares treated with herbicide, in 2019 the herbicide area was spread over 3.78 million hectares, representing an increase of approximately 5.44%. Analysing by development regions, the largest contribution to this growth has the Southern region, and the region that decreases the average is the North-West region, where there is a decrease of chemically herbicidal areas.

Table 4. Statistical indicators on the herbicide area (hectares)

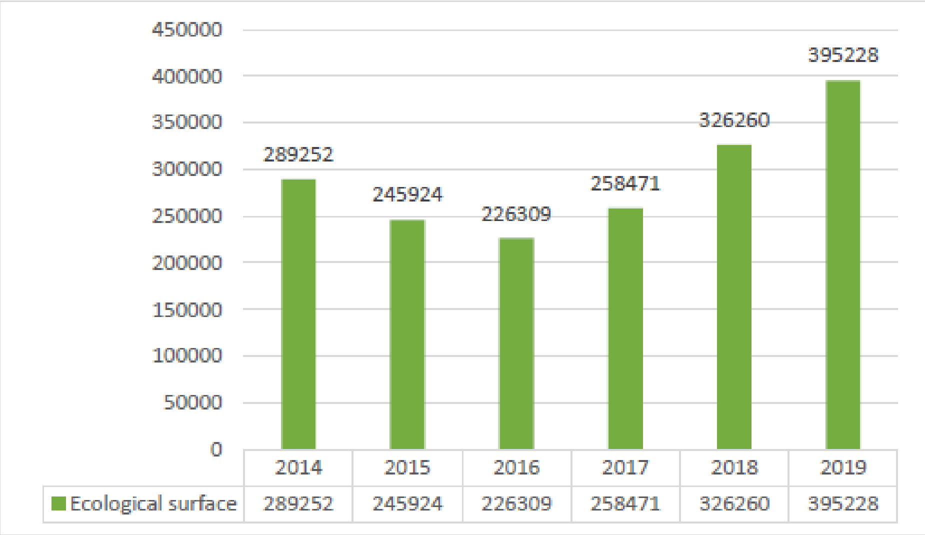
	N	Minimum	Maximum	Mean	Std. Deviation
TOTAL	6	3 304 749,00	3 778 820,00	3 537 340,0000	159 315,83120
Central	6	175 887,00	226 124,00	202 725,3333	21 571,20402
Northeast	6	384 330,00	553 801,00	448 316,0000	63 673,01236
Southeast	6	617 202,00	734 019,00	668 669,3333	39 349,96827
South Muntenia	6	850 803,00	1 008 926,00	925 597,0000	66 869,78352
Southwest	6	342 957,00	503 843,00	429 667,6667	58 495,42054
Weast	6	487 505,00	542 570,00	517 663,3333	25 735,48348
Northwest	6	203 290,00	433 558,00	310 592,6667	88 471,52206
Bucharest Ilfov	6	23 788,00	41 728,00	34 108,6667	67 18,32487

Source: processing based on SPSS data

Analysing the main statistical indicators for the data in table 3, the following can be stated: the total area of Romania where herbicides were administered, varied in the analysed period, between 3.3 million ha and 3.78 million ha. On average, the area fertilized with chemical fertilizers was 3.54 million hectares, from this average there is a standard deviation of 159 thousand hectares, which determines a coefficient of variation of 4.5%. Analyzing by development regions, the coefficient of variation of the herbicidal surfaces varied depending on the region between 5 and 28%.

Regarding the cultivated area in the ecological system, there are data on it based on Eurostat, thus, the figure shows the areas fully converted to the ecological system in the period 2014-2019 in Romania.

Figure 3. The ecological surface cultivated in Romania (hectares)



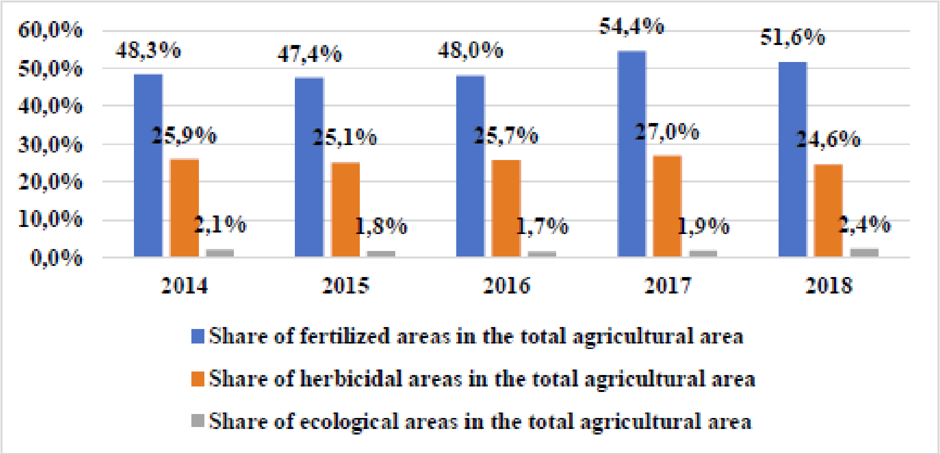
Source: processing based on EUROSTAT data

As can be seen from Figure 3, the ecological area cultivated in Romania registered two trends in the analysed period from 2014 to 2016 there is a decrease in areas, to a minimum of 226.3 thousand hectares, and in 2017 -2019 there is an increasing dynamic, reaching the maximum period of 395 thousand hectares.

Overall, overall, there is an upward trend, with an average growth rate of 6.44% per year. Throughout the period, the average area cultivated in the ecological system was 290 thousand hectares, with a rather large deviation from it of 62.3 thousand hectares, which led to a high coefficient of variation of 21.5%.. Thus, it can be appreciated that although the ecological areas are increasing, they change quite a lot from one year to another.

Next, the weights of the previously mentioned areas were determined, respectively of the areas fertilized with chemical fertilizers, of the herbicide areas and of those cultivated in ecological system in the total agricultural area in Romania.

Figure 4. The share of fertilized, herbicidal and ecological areas in the total agricultural area.



Source: processing based on NIS, FAOSTAT, EUROSTAT, data

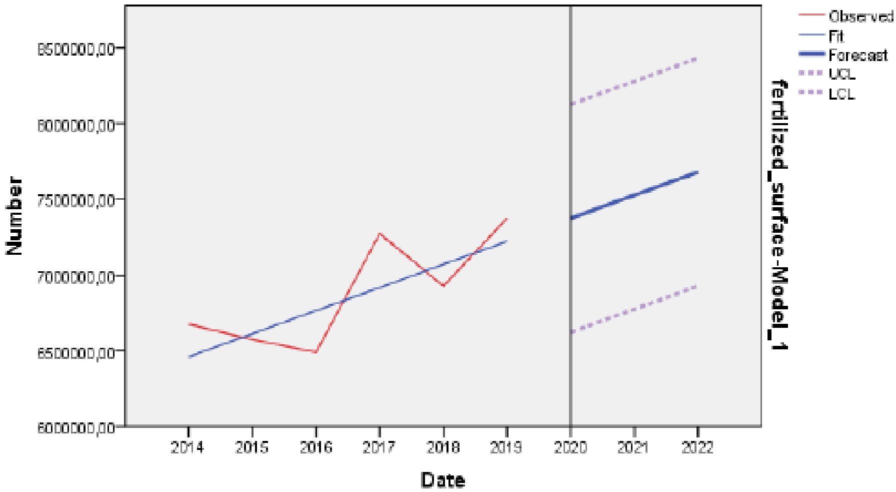
It can be seen that the largest share of the above mentioned areas was recorded for the one fertilized with chemical fertilizers, thus, during the analysed period, the share of this type of area ranged between 47.4% and 54.4% of the total agricultural area. . The share of the herbicidal area in the total agricultural area varied between 24.6% and 27%.

Although the high degree of fragmentation of agricultural holdings in Romania is known, and the semi-subsistence character of some households, it can be stated that half of the country's agricultural area is involved in a developed agriculture, maybe even intensive, regardless the form of its organization (lease, association, cooperation) as suggested by the share of fertilized areas.

Although for the rest of the farms, small and very small, organic farming might be better suited, it is present in a rather small proportion, measured by area, as can be seen in Figure 4, the share of area ecological total agricultural area varies between 1.7% and 2.43%.

To determine future developments in conventional and organic areas and to be able to identify a situation of equilibrium, both in order to obtain sufficient agricultural products to ensure food security and in order to conserve resources and for future generations and to maintain or reduce pollution levels, is the transition to organic farming, forecasts have been made on these areas.

Figure 5. Forecast of the evolution of fertilized areas (hectares)

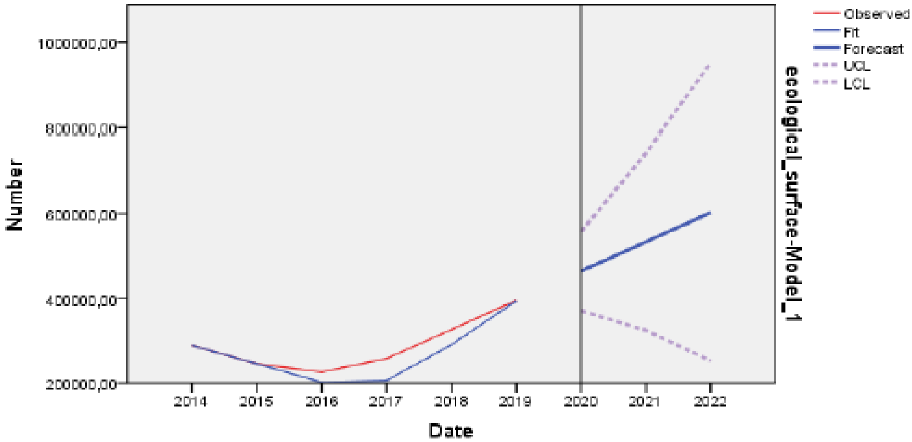


Source: own processing using SPSS

Following the forecast of the areas on which chemical fertilizers are administered, which can be assimilated with the area on which an intensive agriculture of conventional type is carried out, it was found that the extent of these areas will increase in the next three years, and depending on the three hypotheses. The situation would be as follows. Most likely, the area fertilized with chemical fertilizers will reach, in three years, an area of about 7.68 million hectares, if we study the pest version the growth will not be very large, it will even decrease the area a little to 6.93 million hectares, but also taking into account the optimistic option, then the extent of fertilized areas would reach 8.43 million hectares.

Realizing the relative difference between these values, it can be appreciated that in three years, in the most probable variant, the fertilized surface will be higher by 4.14%, and in the optimized variant, it will be higher by 14.3%. These areas will represent about 56.4% of the agricultural area (probable variant) or 62% of the agricultural area (optimistic variant).

Figure 6. Forecast of the evolution of ecological areas (hectares)



Source: own processing using SPSS

Following the forecast of the ecological area, it was found that the extent of these areas will increase in the next three years, and depending on the three hypotheses the situation would be as follows. Most likely, the ecological area will reach, in three years, an area of about 602 thousand hectares, if we study the pesticide version there will be a decrease in area, when there will be 253 thousand hectares, but also taking into account the optimistic version, then the area of ecological areas would reach 951 thousand hectares.

Realizing the relative difference between these values, it can be appreciated that in three years, in the most probable variant, the ecological surface will be higher by 52.3%, and in the optimized variant it will be higher than 2.4 times. These areas will represent about 4.4% of the agricultural area (probable variant) or 7% of the agricultural area (optimistic variant).

Conclusions

The present study comparatively analysed the cultivated areas in conventional and ecological system, in order to determine their share in the agricultural area of Romania, in the period 2014-2019, in the 8 development regions. Being still at the beginning, organic agriculture in Romania has a dynamic character, registering an increasing trend in recent years, whether it is the vegetable or livestock sector.

In recent years, in Romania there has been a rapid and constant growth of agricultural areas and the number of operators who have adhered to environmental standards, our country ranking 11th in the European hierarchy.

Following the analysis of the dynamics of agricultural areas in Romania, it was found that the general trend of these areas is a decreasing one, registering a decrease in the analysed period of three present.

In order to compare the conventional areas with the ecological ones, the areas fertilized with chemical fertilizers that can be classified as areas on which a conventional agricultural system is practiced were taken into account. During 2014-2019, the areas where fertilizers were administered increased, which may lead to the idea that agriculture in Romania has experienced a greater degree of intensification.

Analysing the areas on which pesticides were administered, respectively the areas with each of the three product groups that are included in this category, and conducting the meeting of areas it was determined that the maximum area of the three categories of plant protection products is that - administered herbicides, these being the most used in Romanian agriculture.

Studying the ecological area, it was found that although the ecological areas are growing, they change quite a lot from one year to another. After determining the weights of the areas specified above, in the total agricultural area, it can be concluded that, during the analysed period, on average, the chemically fertilized areas had a share in the total agricultural area of about 50%, the areas on which fertilizers were applied. They had a share in total agricultural land, of 25.7%, and the ecological area had a share of 2%.

Following the forecasts on chemically fertilized and ecological surfaces, the following aspects can be observed: in a most probable variant, the conventional surface would increase by 4%, reaching a total weight of 56%, and in an optimistic variant. , the increase would be much higher. Regarding the ecological area, most likely, there will be an increase in the next three years of about 52%, reaching these areas to represent about 4.4%.

Adding up the two projected weights, it can be estimated that the two agricultural systems will have a total share of about 60.8% of the total agricultural land, thus remaining a significant area that can be granted to individual households and semi-subsistence farms, or uncultivated land. These areas are better suited to organic farming, so converting these areas can lead to the optimistic scenario in which organic areas will hold about 7% of the land area.

Finally, it can be stated that the development potential of ecological areas in Romania has not reached maturity, there is room for growth for these areas, even if we take into account the optimistic growth options will still remain an available area that can be attributed to between the two agrarian systems.

Literature

1. Bratulescu (Manolache) Alexandra Marina, Petre Ionut Laurentiu, Marcuta Liviu, Marcuta Alina Gabriela, 2019: The necessary of labor force in the two conventional and ecological agricultural systems, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 19, Issue 2, 2019 PRINT ISSN 2284-7995, E-ISSN 2285-3952, pages 31-34.
2. Brumă, I.S., Tanasă, (n.d): Termeni şi noțiuni de agricultură ecologică, (Terms and notions of organic agriculture).
3. Ionita Niculina, Marcuta Liviu, Marcuta Alina (2018): The evolution of agricultural holdings in macro-region four (South West-Oltenia) after Romania's integration into the European Union, Scientific Papers: Management, Economic Engineering in Agriculture & Rural Development, Vol. 18, Issue 2, PRINT ISSN 2284-7995, E-ISSN 2285-3952, pages 255-258.
4. Marcuta Liviu, Marcuta Alina, Angelescu Carmen (2013): Effects of the Economic Crisis on the Standard of Living in Romania, Procedia Economics and Finance, Volume: 6, pages: 89-95.
5. Mărcuță, A., Mărcuță L., Tindeche, C., Angelescu, C., Niculae, I., 2014: the influence of economic crisis on the labour in the European Union's member states, Scientific Papers: Management, Economic Engineering in Agriculture & Rural Development, Vol. 14(1):201.206.
6. Petre, I. L., 2018: Comparative Labor Force Analysis in Conventional and Ecological Agriculture – Oleaginous Plants, Agrarian Economy and Rural Development Realities and Perspectives for Romania International Symposium The 9 Edition, Research Institute For Agriculture Economy And Rural Development.

Internet sources:

7. EUROSTAT- https://ec.europa.eu/eurostat
8. FAOSTAT- Food and Agriculture Organization of the United Nations- http://www.fao.org/faostat/en/
9. NIS - National Institute of Statistics – www.insse.ro
10. SPSS-SPSS Statistics

RESEARCH OF THE EFFICIENCY OF PROMOTION OF A TOURIST PRODUCT IN THE INTERNET SPACE

Anastasia Masalova[1], *Anna Ivolga*[2]

Abstract

The influence of the Internet on human life is steadily increasing. In the article, the features of the use of social networks and the dissemination of information about travel products using specific social networks, and both positive and negative aspects of online promotion are shown, along with the features of audience involvement in the process of communication with a travel organization online.

Key words: *tourism product, Internet, online space, promotion, social networks, search engines.*

Introduction

The topic of promoting a tourist product in the Internet space is one of the most relevant. In the Internet, as in a special communication space, new structural relationships are created, as well as communicative connections and interactions. Since the result of a service, as a rule, implies an intangible expression, communication in this area is not only an information-rich process, but also a factor that influences the expectations of consumers, as well as the perception of the quality of service by the latter.

For the effective promotion of a tourist product, it is necessary to determine the target audience of consumers. The advantage of Internet resources lies in the simplicity of identifying the consumers of the tourist product. And, accordingly, the promotion of tourism products and services using the Internet is much more effective than offline means. In addition, tools for promoting a tourist product online allow using settings to correlate offers and the corresponding category of potential consumers. An effective tool is also the possibility of targeted display of offers, which means showing them to consumers who have previously shown interest in certain tourist products or their characteristics.

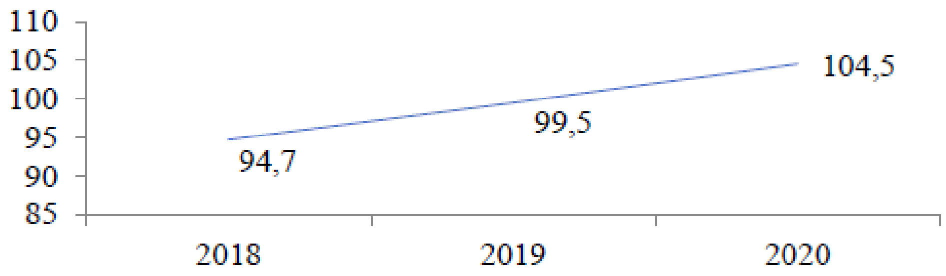
1 Anastasia Masalova, Master student, Stavropol State Agrarian University, 12 Zootekhnichesky Side-Street, 355017 Stavropol, Russian Federation, Phone: +896 147 66 471, E-mail: boomblow@mail.ru

2 Anna Ivolga, Ph.D. in Economics, Associate Professor, Stavropol State Agrarian University, 12 Zootekhnichesky Side-Street, 355017 Stavropol, Russian Federation, Phone: +892 800 535 42, E-mail: annya_iv@mail.ru

The essence of Internet resources in this case is to convey information about the tourist product to the target consumer and to form his desire to use the offer of the tour operator. It is indicative that consumers of tourist products are increasingly using the Internet, and the sale of tourist products is still mainly offline, although the share of online bookings is constantly growing. This pattern indicates that currently not all reserves and opportunities are used to promote and sell a tourist product online [1].

Based on the data of the All-Russian Omnibus GfK, it follows that at the beginning of 2018 94.7 million users were registered in the Russian part of the Internet, by 2019 - 99.5 million, by 2020 - already 104.5 million users (that is, 75, 4% of the adult population). At least once a month, 83.8 million of them went online. (77%). 77.7 million people (68.8%) use the Internet every day (Figure 1) [2].

Figure 1. Dynamics of the number of Russian Internet users, million people.



Source: https://fom.ru/ (accessed: 11/08/2020) [2].

Figure 1 shows that for the period 2018-2020. the number of Internet users in Russia increased by 9.8 million people, or 10.3%, which statistically confirms the growth trend of Internet users.

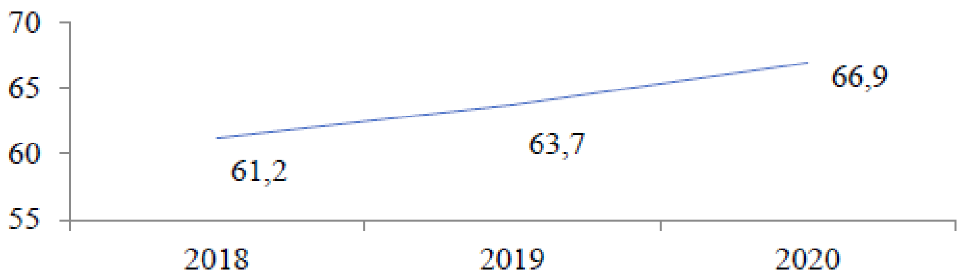
Interesting patterns can be seen in the activity of Internet users: the most active are young people aged 25-34, as well as residents of large settlements. This is the category that is characterized by the greatest activity in terms of travel, has a variety of interests, is aimed at communication and the acquisition of new experiences. But the focus on this age category does not provide full coverage of the tourist services market. The use of Internet resources does not exclude promotion through offline sources. These means of promoting tourism products should complement each other, since not all consumers are active participants in the Internet [1].

According to research by E. V. Viktorova and E. R. Batkaeva, the main purpose of visiting the Internet is communication (communication): 95% of respondents aged 14 to 30 years. At the same time, 57% of respondents go to the Internet every day and spend 2 to 4 hours on it, 37% - more than 4 hours every day, 6% - one hour or less [1].

The most popular communication channels are social media, which can be defined as "a variety of activities for the creation and exchange of information in which many users participate via the Internet." The main channels of communication in the Internet space include: sites, search engines, review portals, video channels, articles and publications in the media, contextual advertising, social networks [3].

Through the study of communication channels, it is possible to identify the factors that determine the effectiveness of promoting a tourist product. The number of sites in the Russian part of the Internet is about 15 million, this is only 6.5% of the total Internet space, Russian users make up only 2.2% of all users. More and more people access the Internet on a mobile device: in 2018, the share of mobile Internet was 61.2%, in 2019 - 63.7%, in 2020 - 66.9% (Figure 2).

Figure 2. Dynamics of the share of mobile Internet, (%).



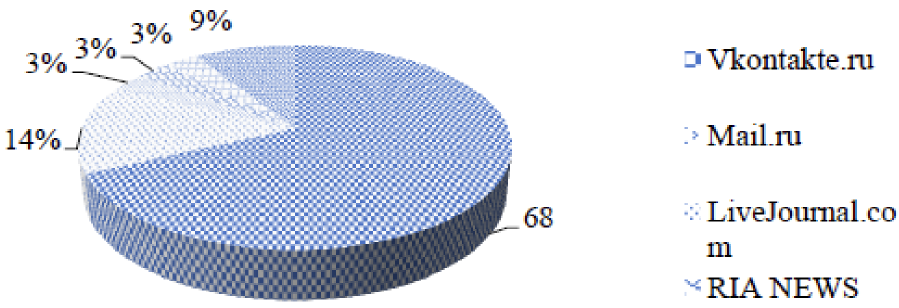
Source: The study of communication channels

Figure 2. shows that over the period of the study, the share of mobile Internet increased by 5.7%, the growth rate of this indicator was 9.3%. Moreover, in 2020 compared to 2019, there is acceleration in the growth of the studied indicator compared to the period of 2018-2019: 5% for the period of 2019-2020. compared to 4.1% for the period 2018-2019.

The most visited sites among Russians are VKontakte.ru (68%), Mail.Ru (14%), LiveJournal.com (3%), RIA Novosti (3%), Komsomolskaya Pravda - Digital (3%) (Figure 3) [3].

Particularly important indicators include search engines and information portals as sources of advertising and information resources that allow the consumer to independently obtain comprehensive information about the characteristics of the tourist product of interest.

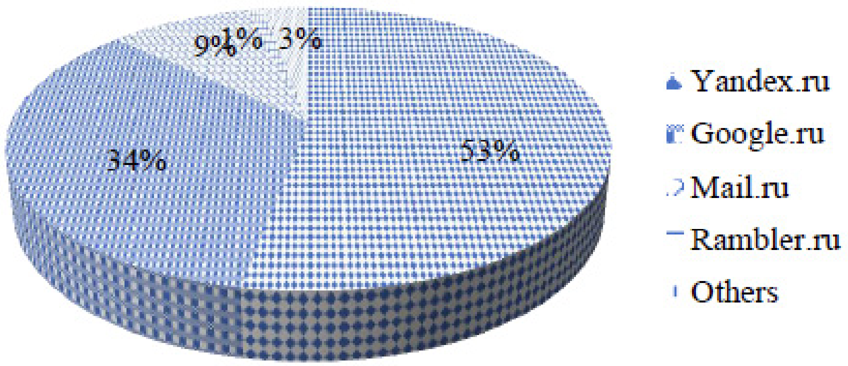
Figure 3. The structure of sites visited by Russian users (%).



Source: https://bogutskiy.org.ua/internet-marketing/sekrety-prodvizheniya (date appeal 08.11.2020) [3].

In our country, the most popular of them are: search engines - Yandex.ru (53%), Google.ru (34%), mail.ru (9%), rambler.ru (1%); review portals - otzovik.com, migreview.com, booking.com, flamp.ru and market.yandex.ru; video hosting sites: YouTube, VKontakte, RuTube, less popular IVI.RU, Video.mail.ru (Figure 4) [2].

Figure 4. The structure of the most popular search engines, (%).



Source: https://fom.ru/ (accessed: 11/08/2020) [2].

The data provided on the Brand Analytics resource allows us to determine that the most popular social networks are VKontakte (VK), Odnoklassniki (OK), Facebook (FB), Instagram, Youtube, Twitter, Moi Mir and Live Journal.

There is also an age differentiation in the question of the attendance of social networks. My World is a social network that is most in demand among older ages (over 55 years old), and the most youthful one is VK (18 to 24 years old). You can also consider social networks for public (VKontakte and Instagram) and personal communication (Odnoklassniki) [2].

Comparison of the popularity of the Internet and TV made it possible to obtain the following data (Table 1).

Table 1. Comparison of indicators of TV media consumption and the Internet in Russia,%

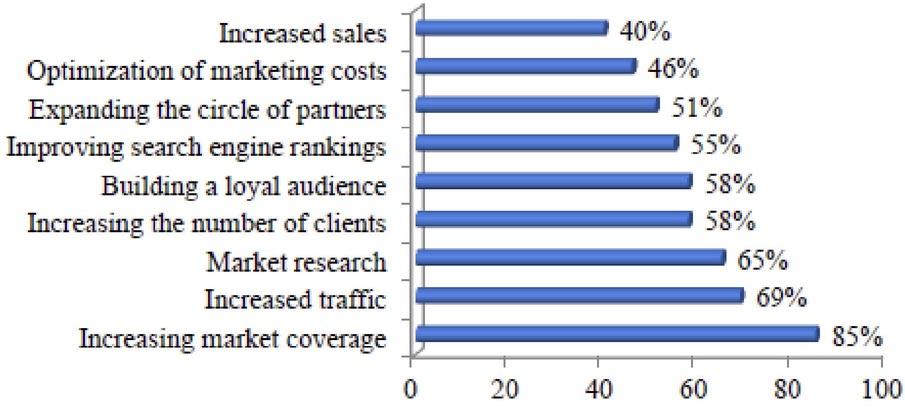
Age group	Average daily coverage in the group,%		Consumption time per person, min / day		Total consumption in the group, mln person-hour / day	
	Internet	TV	Internet	TV	Internet	TV
12-17	84	65	280	127	235,2	82,55
18-24	88	58	220	136	193,6	78,88
25-44	71	74	180	233	127,8	172,4
45+	23	85	90	352	20,7	299,2

Source: https://cyberleninka.ru/article/n/vozmozhnosti-prodvizheniya-turprodukta-v-internet-prostranstve

From the data in Table 1, it follows that in terms of the average daily coverage of the Internet, it is 1.5 times higher than that of television in young age categories (12-17 and 18-24 years old), in fact it has equal indicators in the most attractive "average" age group for advertisers. group (25-44 years old) and 4 times inferior to television in people after 45 years.

It follows from this that tourism enterprises not only need to maintain their channels for promoting services on the Internet, but also conduct research to identify newer channels to attract more customers. These channels include social platforms - SMM (Social media marketing). Such units in social networks are created precisely to draw attention to a brand / product. SMM - channels pursue goals such as simplifying the impact on the consumer, maintaining customer interest, increasing sales, promoting the company's brand, as well as creating and maintaining a favorable image of the organization (Figure 5).

Figure 5. The main goals of social media advertising.



Source: https://cyberleninka.ru/article/n/vozmozhnosti-prodvizheniya-turprodukta-v-internet-prostranstve

However, the tourism business deals with intangible goods, therefore, some features of the use of Internet technologies in tourism should be taken into account (Table 2).

Table 2. Distinctive features of doing tourism business in social networks

Feature	Characteristic
Relevance	It is necessary to warn the tourist about fluctuations in exchange rates, changes in the number of seats on the flight
Feedback	It is necessary to answer frequently asked questions from customers, since obtaining comprehensive information about a tourist product increases the likelihood that a tourist will purchase a tourist product from this particular company
Full disclosure of the features of the tourist product	It is necessary to highlight not only the positive, but also the negative aspects of rest at the resort

Source: Authors research

But one should not assume that online promotion of a travel product has, by definition, only positive aspects. In addition to the positive, there are also negative aspects of promoting a tourist product on the Internet (Table 3).

Table 3. SWOT analysis of On-line promotion of a tourism product.

Strengths (S)	Weaknesses (W)
- convenience in organizing feedback; - reduction of marketing expenses; - the possibility of remote payment; - automatic accounting of information	- dependence on search engines; - opaque pricing scheme; - the impossibility of quick return; - limited number of participants; - data security issues.
Opportunities (O)	**Treats (T)**
- significant cost reduction; - optimization of the staff of the travel agency; - significant acceleration of customer service	- kiberate attacks; - disappointment of the company's management due to the slow return; - problems associated with congestion of search engines

Source: Authors research

Proceeding from this, it is necessary to comprehensively take into account possible shortcomings typical for working in the Internet space, as well as step by step elimination of them as users become involved.

The main feature of promotion in the Internet space is the focus on the formation of consumer engagement - an indicator of the audience's interest in the information presented, which is expressed in the number of likes, reposts, comments, active participation in contests, quests, etc. Ways to increase engagement are: polls, problematic topics, mentions, emotional posts, interactive.

Social media is a channel for acquiring new customers. Indeed, sites and search engines are in demand, first of all, among consumers with developed needs, who are able to assess the quality of the presented tourist product. At the same time, social media allows you to attract the attention of new customers through entertainment content, information for recreation and through communication. Therefore, it is necessary to take into account the peculiarities of a particular social network for the most effective promotion of a tourist product (table 4) [3].

Table 4. Application of features of social networks to promote a tourist product

Social network	Promoted products	Application for travel business
Instagram	-fashion; -beauty and health; -cooking; -travel	suitable for promoting various tourism products
VK	-goods and services with discounts; -goods of mass demand; -cheap products; -products of impulse demand	- “hot” tours, -excursions with discounts, -advertising tourism products through free master classes
OK	-inexpensive goods; -goods of mass demand; -products of impulse demand	suitable for promoting low-cost products and services designed for impulse demand

Source: https://bogutskiy.org.ua/internet-marketing/sekrety-prodvizheniya (date appeal 08.11.2020) [3].

Consciously spending time in social networks, a person multiplies his own social efficiency and satisfies his basic need for emotional contact. Knowing these reasons, one can understand why more than a third of international travelers use smartphones to access social networks - they publish content on their blogs, on Facebook pages, and share photos on Instagram when they are traveling. Let’s consider the possibilities of using social networks in the travel industry to maximize the return on attracting consumers (Table 5).

Instagram is the most versatile and promising social network, as it offers ample opportunities for the quick and effective promotion of a tourist product. Since it is convenient to upload photos to Instagram from places where tourists are staying, the demand for this resource is steadily increasing. It is an indispensable travel companion as it allows you to immediately share new photos with your subscribers. The main rule of account management here is a uniform style. It is also convenient for companies on Instagram to keep in touch with their tourists. Since Instagram is convenient for posting photos and stories, this social network should become an integral companion of a tourism organization to promote tourism products.

Table 5. Reserves for the promotion of a tourist product in social networks

Social network	Age group	Tourist product	Promotion method
VK.RU	16-35	- youth tours; - excursions; - wedding tours; - festivals tours	- targeted advertising; - promotion in public; - application integration
OK.RU	35-55	- inexpensive tours for the whole family; - tours for clients with average income; - tours without children	- it is necessary to create open groups and invite users; - evaluation of the post gives access to the information in it to all the user's friends
Facebook	25-45	- expensive tours; - tours with good insurance	- evaluation of the effectiveness of the advertising campaign; - availability of high-precision targeting; - promotion of groups
Instagram	different age groups	the most convenient and promising social network for promoting travel products	-promoting using hashtags; -effective maintenance of feedback with tourists

Source: Authors research

In this regard, it is necessary to consider the methods of promotion on the Instagram network, which make it possible to maximally attract the attention of potential consumers to the proposed tourist product (Table 6).

Thus, different channels of information dissemination are targeted at different consumer audiences with similar needs and behaviors. The use of each channel in the promotion of tourist services should be based on the use of their own methods of communication, effective specifically for this channel.

Table 6. Methods of promoting a tourist product on Instagram

Method of promoting a tourist product	Characteristic
1. Real photos of places your tourists have already visited	Unique photos of the tour taken by the guide or tourists
2. Reviews and recommendations of tourists	Such a move can immediately attract the attention of the Instagram audience and accelerate the return on the promotion of a tourist product on the network
3. Lighting the nuances of the tour	When developing an offer for a tourist, it is necessary to introduce details and support the information with strong arguments (for example, unique photos of the tour)
4. Promotion by competitors hashtags	Use words that are actively used by competitors
5. Travel Tips	It is important to write short guides for tourists
6. Video	It is possible to increase the profitability of the company by posting short videos with useful tips and a brief presentation of the tour

Source: Authors research

But there is an increase in interest among all age groups to the Instagram social network, which makes it universal and most convenient for maintaining feedback from a tourist organization with tourists and, therefore, increases the rate of return from online advertising of a tourist product. The most popular search engines in Russia are Yandex (53%) and Google (34%). However, they are designed primarily for users with established needs, so it is social networks that help attract new customers. Since the promotion of a tourist product on the Internet has not only positive but also negative sides, it is necessary to work out the probable and existing shortcomings as consumers are involved in the Online mode, and also to combine it with offline methods.

Literature

1. Viktorova EV, Batkaeva ER Impression as a component and factor of socialization in the communicative space of the Internet // Communicology. - 2017. - T. 5. - No. 1., p.92.
2. Internet in Russia: the dynamics of penetration. Winter 2019-2020. Internet audience: total volume, structure, gender distribution, consumer goods and federal funds. - URL: https://fom.ru/ (accessed: 11/08/2020).
3. Opportunities for promoting tourism products in the Internet space / Scientific electronic library "CyberLeninka" // Radygina Evgenia Gennadievna [electronic resource], 2020. - URL: https://bogutskiy.org.ua/internet-marketing/sekrety-prodvizheniya (date appeal 08.11.2020)

INNOVATIONS IN THE FUNCTION OF COMPETITIVE ADVANTAGE OF BAZAARS ON MARKET[1]

Boris Kuzman[2], Nedeljko Prdić[3], Anton Puškarić[4]

Abstract

By analyzing the importance of bazaars on domestic market we want to ascertain and acknowledge their historical, modern and future role on market of agriculture products. Innovations, as continuous adjustments to market conditions, deem necessary adoption of changes in doing business. The objective of this paper is to emphasize the importance of innovations in business and good communication with public on the bases of social marketing. Results of the research have provided a solid foundation for conclusion that the implementation of innovations may contribute to the competitive advantage for bazaars on the market. The conclusion is as well that the activities of social marketing may lead to a better communication with customers for fulfillment of the basic role of bazaars for supply of fresh agriculture products for residents, and acknowledging their importance.

Key words: *innovations, investments, bazaars, competitive advantage, market, social marketing.*

Introduction

In historical context of society and commerce development, bazaars had have special role. Development of commerce in agriculture has produced complex relations between bazaars, shops and consumers. Basic problem this paper deals with is analysis, forming integrated communication model that would embrace all kinds of communication processes between interested parts, and it would be base for solving the problem of innovation implementation. These integration models would represent the foundation for implementation of innovation in business practice of bazaars, and also an incentive for develop-

1 This paper is a part of the research supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

2 Boris Kuzman, Ph.D., Associate Professor, Senior Research Fellow, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 63 299 111, E-mail: kuzmanboris@yahoo.com

3 Nedeljko Prdić, Ph.D., Research Associate, JKP Tržnica, Đorđa Servickog Street no. 2a/6, 21000 Novi Sad, Serbia, Phone: +381 500 818, E-mail: ekonomistdoo@sbb.rs

4 Anton Puškarić, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 69 72 858, E-mail: anton.puskaric@gmail.com

ment of communication model that are objects of interests for science institutions for marketing and market.The final objective is forming the model of integrated communication that would lead to innovation implementation and their usage for satisfaction of mutual interests of bazaars, on the bases of social marketing. By solving problems and aims of research, we start from current state of bazaar markets, existing literature, and authors' experience and designated empirical reviews. In global sense, the projection of bazaar business should be looked for between further supply enrichment in content, infrastructure arrangement and assortment on one side, and preserving their peculiarities, on the other side. (Lovreta, 2008).

Active usage of innovations in bazaar business leads to changes in market portfolio and creates advantage over competitors. It is necessary to mention that secondary sources of data from existing literature and authors' experience are used for this research, and primary data are collected on terrain researches.

Innovations as condition for market positioning of bazaars

The aims of innovation implementations in bazaar business are:

- Improvement of quality and variety of service in bazaars on market
- Creation of conditions for increased commerce for food produce by technology equipment and temporary storage
- Defining and implementation of product quality control standards in cooperation with other interested entities
- creating special conditions for sale of domestic products with geographic origin marks, production of safe food from healthy environment
- creating brand of domestic products on separate parts of bazaar
- help of bazaars in communication with authorized administration for incentives in domestic products manufacture
- innovation technologies enabling synchronised communication between manufacturers, bazaars and wholesales markets
- creating unique interest between bazaars as bases of sale, with agriculture fairs, stock markets and other institutions of regional and wider trade
- Innovations for integrated marketing innovations in communication with target market.

With adopted strategy of precisely defined standards of innovation involvement, it is possible faster and simpler to determine extent of realised and gap between plan and realisation. (Prdić, 2019).The aforementioned implies that greatest problems of bazaars, due to lack of innovation implementation, are economic and service inefficiencies. Based on communication cognition and authors' experience, we can tell that domestic bazaars do not make changes in their business. There are changes that are related to quality of provided service, and investments and innovations in business. The greatest number of bazaars functions on old "communal" principle, not seeing changes on market and competitors activities. In such circumstances, the knowledge and creativity of employees remain unused potential of bazaars. Based on knowledge during research, a great number of employees on bazaars in Serbia remain to work for over twenty years in these companies, so that resource is very important for bazaar development upgrading experience in work with new knowledge.

On the example of research on employees potential in JKP Tržnica Novi Sadon the scale of 1 – 10, question if they have and if they could implement new ideas in bazaar business, answer had average score 7. When it comes to potential that may contribute to bazaar development using innovations, on the sample of 120 employees, the results are:

- 60% of examinees think that they have potential that could be used for bazaars development
- 30% examinees think that they should be implemented but has no special idea
- 10% examinees think that better service level may maintain competitiveness of bazaars

About previous research it is necessary to mention that it was conducted on the sample of 120employees and those employees below secondary education have not been questioned. When we compare this number with total number, the percent of interviewed is above 70%.When it comes to education for successful implementation of innovations and modern technologies in the sample of 90 employees, the results are:

- I accept innovations and new technologies 40%
- I want to educate because of market changes and competition 27%
- Our renters and consumers will achieve economic 20%
- We will be more competitive on the market 13%.

Previous research shows awareness of employees about the necessity of changes. These changes and implementation of new knowledge by employees show awareness and responsibility for needs of company, renters and consumers.

When we speak about attitude of renters, on the sample of 30 sellers of fruit and vegetables on Fish Market in period 1-10th June 2020about innovation implementation, the answers are:

- it is necessary 65%
- probably yes 25%
- Existing services should be improved 10%.

The conclusion is that great majority of renters – sellers think innovations are necessary. They are key element for business success in the future, having in mind competitive markets. About the future of bazaars, the same sample provided following answers (answer all given possibilities, please):

a) Creating conditions for innovations implementation on bazaar 1 2 3 4 5
b) Implementing technology systems for better conditions of sale and quality control of work on bazaars 1 2 3 4 5
c) Adjustment of working conditions to customers' needs 1 2 3 4 5
d) Enrichment of supply of organic food from healthy environment of domestic producers 1 2 3 4 5
e) Stressing the importance of bazaars as local brands 1 2 3 4 5
f) Social marketing for bazaars promotion 1 2 3 4 5
g) Other services, parking and others. 1 2 3 4 5.

Results of question marked by letter a show that average mark is four. Renters realise that innovations make greater chances for sale of their products. Result market by b also has average mark 4, and candidates' explain that based on research experience, as chance for sales increase. Answer marked with letter ц has also mark 4 since sellers understand that their interest is connected with consumer interests. The result with letter is marked with 3. Sellers think that there is not sufficient economic care for domestic producers of organic food supply. Answers market with letters e, f and gore graded with mark 3 since sellers think that bazaars as service companies have to take care of marketing and other services.

When speaking about attitudes of 30 vegetable and fruit sellers on market „Zeleni Venac" in Belgrade (the same questions), about innovation implementation in business, in period 15 to 20 June 2020,the answers are:

- it is necessary 70%
- probably yes 20%
- Existing services should be improved 10%.

This research shows nearly the same results as on Riblja market. We should mention that the bazaars „Zeleni Venac“ and Fish Market are among the eldest bazaars that provide consumers by fruit and vegetables.

When speaking about data from Zeleni Venac the first four answers have grade 4. During the inquiry and acquiring communication-based knowledge, we concluded that renters have given greater grade to changes that may bring them greater economic benefits. The rest three answers in the sense of market development in the future are market by average mark 3since they think that bazaars as service companies have to take care of marketing and other services.

Direct trade on markets enables adjustability of sellers to current market state, in the sense of product price. (Kuzman et al, 2019).

The work paper wants to show the historical significance of markets in creating prices of agriculture products on market, on one side, and to show how competitiveness may be preserved and improved, on the other side. Summing all the margins of contribution lines performed in the farm, a total contribution margin could be obtained. This margin will clearly reflect the valorisati on of the success of the whole business activity. (Subić et al, 2019).

Healthy ecological products on Fish Market have separate „street“ for selling domestic safe products. Sales usually go on weekends and there are buyers that are ready to pay ecological vegetable from healthy environment**.**

It is obvious that there is a growing demand in rural tourism everywhere in the world, and it is driven by two factors: craving for authenticity and the desire for better life quality.(Cvijanović et al, 2019).

In Autonomous Region of Vojvodina, as an area with great production of fruit, vegetables, diary, meat and meat products, it is necessary to organise individual husbandries in joint selling sector. If, as place for sale we take bazaars, we would have direct information about prices, quality and influence of market on further development, and new models of development based on costumers’ attitudes. Circling the efficient model of village area development in order to improve agriculture production is also possible by connecting touristic potential in form of tourism and rural tourism.

Rural development concept should contribute to decrease of pressure on urban areas and to steady state development. (Matijašević et al., 2014).If we know that rural areas comprise roughly 85% territory of Serbia and agriculture is basic business of that area, it is clear that it is necessary to invest in that economy sector. Investing in rural development concept would keep people in village areas and improve agriculture production. Bazaar market and adequate buyout of production surpluses would enable agriculture development and survival of inhabitants of rural areas. Local needs are still bigger than local production in this area. (Ostojić et al, 2019).

When speaking about regional markets, we may see tendency of harmonized production in agriculture food industry, especially of production of fruit, vegetable, meat and other products. Meat production has a log tradition in Serbia and it is the part of strategy of harmonized development of domestic production and export. If we resume based on exposed, we can see that the development of agriculture production is very important. It contributes to rural areas development, individual production and farmers' standard development, supports market development and enables estimation of state of total economy in agriculture. The conclusion is that bazaars are the first and basic market intermediate for measurement of domestic agriculture state. Involving innovation in their business would create conditions for joint program of development with individual agriculture producers.

The role of social marketing in realisation of better performances of bazaars on market

Observing the importance of social marketing in public sector functioning, it is necessary to define goals of enterprise by innovation implementation. If we analyse market position of JKP Tržnica Novi Sad, it is necessary to define strategy of enterprise by innovation implementation. That strategy has to be harmonized with costumers' interests and social role of enterprise. After goals defining, the enterprise has to adopt key elements of social marketing, based on strategic planning. Above all, the role of social marketing has the aim to stress the importance of innovation implementation in business, and all subjects have interest for that. Process of introducing social marketing should be integrated with innovation implementation in business of enterprise. First, it is necessary to analyse bazaar position on the market and based on marketing research, reveal attitudes of sellers, consumers and competitors. Total activities of social marketing present combination of economic, communication and educational strategies that result in technological and informatics changes, at the end. Marketing becomes the best platform in public agency that wants to fulfil citizens' needs and deliver real value. (Kotler & Lee, 2008).

The greatest competition to domestic individual producers in modern time are supermarkets and discount centres. At the same time, they are greatest competition to bazaars that have to find a good and mutually acceptable mechanism of common interests with producers. If we add consumers' habits for bazaar purchase, it is clear that bazaars and producers have to make marketing effort to stress the importance of bazaars as places of traditional trade, healthy products from preserved environment. (Prdić et al., 2019).

Based on gained information, bazaars take a series of marketing instruments in order to attract buyers for purchase, even using "brand" with name of the bazaar in promotion. After the analysis, it is necessary to define strategy of social marketing that will stress the importance of innovations and changes they bring, to the public. By this strategy, the public sector enterprise, through promotion, publicity and its own communication, influence social community, target groups and other pubic, stressing the importance of technologic innovation and informatics innovations, in order to fulfil economic interests of individuals and social community. Measuring of social marketing effects in public companies, requires competencies and engagement on finding methods for measurement of social marketing efficiency for growth and development of company. Efficiency consists from concrete benefits and effects that social marketing brings to company development. (Prdić, 2015).

Critical look and recommendations of research

Analysis of research leads to the conclusion that domestic public companies on local level, and observed enterprise do not have adopted strategy of innovation implementation, and its promotion through means of social marketing. Research shows that enterprises have not realised the importance of innovation implementation. By using strategy of innovation implementing, public local enterprises gain economic and social benefits, as one of postulates of their existence. Strategy of innovation implementation has to be harmonised with total business strategy. The resolution of bazaar management to implement innovation and define target market is the bases of strategy implementation. After that, it is necessary to identify all possibilities and resources for innovation implementation for satisfaction of service users and final consumers. In historical sense, bazaars are multifunctional markets for agriculture products, unique source of information, and presentation of domestic production state, reputation of market and social institution of specific importance. It is necessary to develop innovative theory of internet markets as separate role of social marketing. In order to make information technologies usable in future functioning of bazaars, it is necessary to abandon personal and partial interests and realise use of technology as information tool for economic aim fulfilment. Results of conducted questionnaire research on Fish Market in Novi Sad and Zeleni Venac in Belgrade show that sellers are interested and have knowledge about internet information and technologic changes contributions to their business success. This conclusion is summary of authors based on visit and conversation. In order to change present situation and see the importance of innovation implementation, it is necessary to indicate the obstacles that exist for domestic bazaars for not embracing these activities, and working on their overcoming.

Conclusion

The state of modern bazaars in Serbia is not satisfying neither from market nor public aspects. When speaking about current state, on the bases of conducted researches, we may observe the lack of care and unclear strategy of future bazaar development. Still, in circumstances of stronger competition the importance of social marketing that would enable status of unique and public places of trade is not seen. The results of research of sellers on two traditionally relevant bazaars show that it is necessary to invest in technological and innovative systems that would enable higher quality of products and integrated communication. Innovations in future become the base of bazaar trade development that will stress traditional importance of bazaars, through social marketing. Attitudes of sellers and employees confirm that future of bazaars in development of innovation information systems that will enable integrated communication with consumers and increase the efficiency of trade. Besides the development of innovation and technologic system, the conclusion is that bazaar development is not possible without provision of additional services like parking spaces, longer staying on bazaars, catering and other services. The research confirms that sellers have clear attitudes on necessity for innovation implementation and apprehension that innovation will contribute to increase of trade of quality and fresh products by lowest prices. Attitudes of employees also confirm that knowledge is basic assumption for innovation implementation that will enable strategic position of bazaars on the market of agriculture products. The conclusion is that the research may contribute to establishing a model of bazaars development in modern conditions of trade and market. This model will emphasise traditional and modern importance of bazaars and enable competitive advantage of bazaars on market.

Literature

1. Cvijanović, D., Gajić, T. (2019): *Assessment of quality of services in rural regions of Vojvodina,* Sustainable agriculture and rural development in terms of the Republic of Serbia strategic goals realization within the Danube region: sustainability and multifunctionality, Institute of agricultural economics, Belgrade, 13-14 December 2018, XIII, pp. 226-243.
2. Kotler, F., Li, N. (2008): *Marketing u javnom sektoru*, Mate, Beograd.
3. Kuzman, B., Prdić, N. (2020): *Specialized market institutions in the function of agriculture development,* Sustainable agriculture and rural development in terms of the Republic of Serbia strategic goals realization within the Danube region: science and practice in the service of agriculture Institute of agricultural economics, Belgrade, 12-13 December 2019, XIII, pp. 131-145.
4. Lovreta, S. (2008): *Strategija trgovine grada Beograda,* Centar za izdavačku delatnost Ekonomskog fakulteta, Beograd, p.281.
5. Matijašević O., Kuzman, B., Kovačević, M. (2014): *Značaj pravne regulative u oblasti ruralnog razvoja Srbije*, Agroekonomika, Novi Sad, Vol.43, br. 63-64, str. 63-74.
6. Ostojić, *A.,* Vaško, Ž. (2019): *Projections of self-sufficiency of Bosnia and Herzegovina in basic types of meat,* Sustainable agriculture and rural development in terms of the Republic of Serbia strategic goals realization within the danube region: sustainability and multifunctionality, Institute of agricultural economics, Belgrade, 13-14 December 2018, XIII, pp. 50-67.
7. Prdić, N. (2019): *Inovacije u funkciji razvoja i investicija,* Međunarodna DQM konferencija Upravljanje kvalitetom i pouzdanošću, Istraživački centar za upravljanje kvalitetom i pouzdanošću, Prijevor, 27-28 Jun, 22, str. 206-211.
8. Prdić, N. (2015): *Model društvenog marketinga u javnom sektoru,* Kulturapolisa, NoviSad, br. 27 (2), str 429-443.
9. Prdić, N., Prdić, I. (2019): *Pijace kao mesto prodaje domaćih poljoprivrednih proizvoda,* IX međunarodni poljoprivredni simpozijum, Održivi razvoj savremene poljoprivredne proizvodnje, Palić, Oktobar, str. 156-164.

10. Subić, J., Jeločnik, M. (2019): *Economic effectiveness of ecologically acceptable production of vegetables in protected area,* Sustainable agriculture and rural development in terms of the Republic of Serbia strategic goals realization within the danube region: sustainability and multifunctionality, Institute of agricultural economics, Belgrade, 13-14 December 2018, XIII, pp. 333-352.

MARGINALIA ON THE ECONOMIC SITUATION OF SMALL FARMERS

Božo Drašković[1], *Dimitrije Aleksić*[2], *Zoran Rajković*[3]

Abstract

Available agricultural land as a natural, productive capital is the primary condition which determines the economic and social position of small and medium individual agricultural producers, organized as agricultural holdings. Depending on the structure of production, i.e. the structure of growing production crops, the quality of land and capital equipment with mechanization on the one hand, and market trends on the other hand, it is conditioned as a dependent variable by the economic and social position of the rural population in Serbia. The situation of the rural agricultural population is deteriorating or improving depending on the market trends, short-term, medium-term and long-term economic policy measures and international competition. Economic measures of strong subsidies implemented in EU countries significantly worsen the economic position of the rural agricultural population in Serbia. Therefore, in Serbia, the size of holdings is not crucial for the position of the rural population, but the impact of unequal competition created and distorted disproportionately by subsidies per hectare of agricultural land, which is provided for farmers in EU countries as opposed to farmers in Serbia. Deformed non-competitiveness of our small agricultural producers is one of the long-term key factors influencing the extinction of villages in Serbia. In the past three decades, economic policy in Serbia did not have a valid answer to this problem.

Key words: *farmers, land, holdings, agriculture, EU countries.*

Introduction

Agricultural arable land in Serbia is a relatively abundant resource. The property is fragmented depending on the region. Concentration of arable land is performed dynamically in the area of AP Vojvodina. In the last two decades, there has been a strong trend of enlarging farms and the extinction of villages and the reduction of production in individual agricultural holdings. The economic efficiency of small farms is low due to unstable economic policy in the agricultural

1 Božo Drašković, Ph.D., Full Professor, Faculty of Applied Ecology „Futura", University Metropoliten, Požeška Street no. 83/A, 11000 Belgrade, Serbia, E-mail: Bozo.Draskovic@futura.edu.rs

2 Dimitrije Aleksić, M.A., Faculty of Applied Ecology „Futura", University Metropoliten, Bulevar Vojvode Mišića no. 37, 11000 Belgrade, Serbia, E-mail: Dimitrije.Aleksic@futura.edu.rs

3 Zoran Rajković, retired researcher, E-mail: Zoran.Rajković@ien.bg.ac.rs

sector, market instability and low income per unit of capital used. The question of the future of small agricultural holdings is open. If the current trend continues, small agricultural producers will disappear in the upcoming decades; there will be an increase in poverty and village depopulation. Large capital will defeat private farms in lowlands. The problem is that Serbia is becoming more and more a primary agricultural producer. On the other hand, there is a decline in agro-industry. Small agricultural farms even with 20 ha of agricultural land are located in the zone of marginal sustainability.

Agricultural land resources and legal organizational form of producers

The high degree of reliability of data regarding the available agricultural land and the structure of the form of organization of agricultural producers in the Republic of Serbia can be found in the relatively fresh database created in 2012 based on the Census of Agriculture.[4] The Republic of Serbia has a total of 5.346.596.5 hectares of land out of which agricultural land is 3.861.477.4 ha or 72.2% of the total land, forest land is 1.023.035.5 ha or 19.1%, and other land is 462.083.6 ha or 8.7%. Of the total available agricultural land, 3.437.723.5 ha or 64.3% is cultivated and 424.053.9 ha or 7.9% is not used (unused).[5] The data presented show that the percentage of unused arable agricultural land is extremely high. Observed by the territorial distribution of agricultural land, the largest share belongs to the region of Vojvodina with 2.049.241 ha or 53.07%. In the total structure of agricultural land used the area of AP Vojvodina has the share of 1.608.896 ha or 46.80%.

In the ownership structure of agricultural land participate de facto 3 actors. According to property rights the division is made into state, private and cooperative. Private property is structured in two groups. The first group consists of family farms, the second of private companies and entrepreneurs. State ownership is the next form of ownership, and the state owns 828.584 ha of agricultural land or 21.46% of the total agricultural land, which was recorded in an area of 3.861.477,4 ha. In 2015, the records of the State-owned Agricultural Land Administration presented data that a total of 489.136 hectares were planned to be leased.[6]

4 Census of Agriculture 2012 in Republic of Serbia, Book I and II, RBS Belgrade 2013.

5 Data source Census of Agriculture 2012. RBS (Republic Bureau of Statistics).

6 Data based on the source. “Analiza pravnog i institucionalnog okvira tržišta poljoprivrednog zemljišta, procena ekonomskih efekata liberalizacije tržišta poljoprivrednog zemljišta i preporuka za izmene zakonodavnog i institucionalnog okvira i njihovu adekvatnu primenu,” Group of authors, Electronic edition p.50, GIZ Belgrade 2016.

According to the organizational structure, users of agricultural land as a natural resource are organized as agricultural producers, i.e. agricultural holdings (AH), which according to the 2012 census have a total of 631.552 and which are divided into two basic groups according to the form of organization. The first and the most numerous group consists of family agricultural holdings (FAH), which according to the 2012 census have a total of 628.552 or 99.5%. The second group are agricultural producers organized in the form of legal entities and / or entrepreneurs (LEE), of which a total of 3.000 or only 0.5% were registered.[7] The presented data indicate that the economic activity of primary agricultural production in Serbia predominantly relies on family farms, and that large agricultural complexes have a relatively small share. The data actually show that the distribution of land ownership rights in Serbia is strongly dispersed to a large number of private family households. The average family farm owns 5.4 ha, while legal entities and entrepreneurs own an average of 204.1 ha of agricultural land.

This distribution of agricultural land does not include agricultural land that both family agricultural holdings (FAH) and legal entities and entrepreneurs (LEE) lease from the state or natural persons - owners of agricultural land. In accordance with the above, the presented data do not show how many total active family agricultural holdings are in terms of production. Empirical data indicate that, for example, one family farm (productively active) not rarely leases agricultural resources (land) from others, inactive in production (FF).[8]

Comparative overview of the size of productive agricultural holdings in the EU and Serbia

According to the available statistical data, the average agricultural holdings is significantly larger in the European Union than in Serbia in terms of the size of agricultural land at its disposal. According to the European Commission, the average area available to farms based on Eurostat data in the EU (28 countries) is approximately 15 ha. According to the data from the census of agriculture in Serbia, the average farm has about 5.44 ha or approximately three times less area compared to the EU average.

From the table presented below (more details in S. Strsoglavec 2017)[9], that in the EU countries the most represented are agricultural farms with less than 2 ha, and

7 Census of Agriculture 2012. RBS.

8 Estimates related to the lease of agricultural land can be found in Prof. Dr. Miladin M. Ševarlić, Agricultural land, Republic Statistical Office, Belgrade 2015.

9 Stela Strsoglavec, *Održivo upravljanje poljoprivrednim zemljištem,* p. 80-81 in Zbornik radova. *Ekonomske, socijalne i razvojne posledice prodaje poloprivrednog zemlčjišta u Srbiji* , Editor, Božo Drašković, Institute of Economic Sciences Belgrade 2017.

their share in total farms is 49.1%, followed by those with 2-5 ha participating with 20.2%. 10.9% of farms have 5-10 ha, while the correct distribution of 3% of participation is available to farms with 20-30 ha; 30-50 ha and 50-100 ha. Only 3% of all agricultural holdings have more than 100 ha.

Table 1. The size of agricultural holdings in EU (28)

The size of a farm in EU	Percentage
< 2 ha	49,1 %
2-5 ha	20,2 %
5-10 ha	10,9 %
10-20 ha	7,5 %
20-30 ha	3%
30-50 ha	3%
50-100 ha	3%
> 100 ha	3%

Source: http://ec.europa.eu/eurostat/data/database

According to the data obtained from the 2012 census of agriculture in the Republic of Serbia, 8% of agricultural holdings have less than 2 ha of agricultural land. The central place in the dispersion of land area per farm belongs to farms that have 2-10 ha of agricultural land and they participate in the total number of farms with 35.3%. 12.7% of agricultural holdings own 10-20 ha. 11.3% of farms have 20-50 ha of agricultural land, and 23.6% of farms have more than 100 ha.

Table 2. The size of agricultural holdings in Serbia

The size of a farm in Serbia	Percentage
< 2 ha	8 %
2-5 ha	17,3 %
5-10 ha	18 %
10-20 ha	12,7 %
20-30 ha	5,4 %
30-50 ha	5,9 %
50-100 ha	9,1 %
> 100 ha	23,6 %

Source: http://webrzs.stat.gov.rs/WebSite/public/ReportView.aspx

A comparative review of data on the size of agricultural holdings in Serbia and the EU (28) shows that the concentration of ownership of agricultural land in Serbia is higher than the EU average. Because on average in the EU, less than 2 ha are owned by 49.1% of farms, and over 80.2% of all farms in EU have less than 2 ha to 10 ha in total. The same framework of comparison which has been applied in Serbia shows that farms that own agricultural land from less than 2 ha to 10 ha, in the total structure of farms participate with 43.3%. The economic efficiency of agricultural holdings is affected not only by the size of holdings, i.e. the size of agricultural land, but also the training of producers, the economic policy of the state, the policy of subsidies, the structure of agricultural production, the development of the agro-industrial sector, the size of the market, climatic conditions, price stability, changes in mechanization and agro technical measures.

Available state agricultural land and its value

In terms of availability of agricultural land as a natural resource, Serbia, in relation to the European Union, belongs to the countries that dispose of land as an abundant factor of production. The structure of total, agricultural, forest and other land is relatively satisfactory. Of the available 5.4 million hectares, agricultural land occupies 3.8 million hectares or 72.2% of the total land. The utilization rate is unsatisfactory and is 64.3%, 7.9% is not used. Forest land covers about 1 million hectares or 19.1% of the total structure.[10] The regional distribution of arable agricultural land is presented in the following table.

Table 3. Available resources of arable agricultural land in Serbia and their dispersion by regions

Region	Area in ha	% total agricultural land
Vojvodina	1.681.000	43,55
Šumadija and West Serbia	1.155.000	29,93
South and East Serbia	876.000	22,69
Area of Belgrade	148.000	3,83
Total	3.860.000	100

Sources: author's calculation based on SBS data, Belgrade, Census of Agriculture 2012.

Of the total available agricultural land in Serbia, there are about 828.584 ha in state ownership, about 489.136 ha are suitable for agricultural production, and about 252 thousand hectares or about 51.52% are leased. The land that is being rented is mostly concentrated in AP Vojvodina.

State-owned agricultural land is leased through local self-government units (LGUs) in tenders for a period of not less than 5 years. The average rent depends on the demand, and above all on the location and fertility of the land and amounts

10 All data from the Census of Agriculture, 2012. SBS, Belgrade

to about 191 € / ha. In the area of AP Vojvodina, according to empirical data from public tenders, the average rent ranges from 240 to 390 € per hectare. The rent price, in addition to speculative flows, is influenced by the size of the plot, its location and the quality of the land.

An interesting issue is the assessment of the value of state-owned agricultural land. There are no reliable data on the value of state-owned agricultural land. It is not known whether state institutions keep any records at all on the value of agricultural land as capital. The solution to this issue would be possible on the basis of the realized amounts of rents, i.e. the rental price paid by the tenants. Considering that direct market indicators based on realized transaction prices in the purchase and sales of land are not reliable due to limited transactions, the value of agricultural state land can be calculated by discounting the rent received from the land lease. A simplified procedure would be based on the following formula by discounting the infinite annuity.

$$x = \frac{r}{i} \qquad (1.1)$$

Where the amount of rent is denoted by “r” and “i” represents the disount factor; the obtained value of agricultural land represents the value of “X”[11]

Case study of empirical sketch of cost-effectiveness of growing crops of corn, wheat and sunflower

The short analysis that follows is based on a survey of an individual agricultural producer - a private farm in the Banat area. The data used in this analysis were obtained from the respondent. The surveyed primary agricultural producer owns 35 chains of agricultural land, first and second class, which corresponds to a size of approximately 20 ha. It has its own mechanization for primary land cultivation. He uses the services of other people to harvest crops. He contracts the production on an annual level, and the organizer of the production finances him with seeds, pesticides and mineral fertilizers. Bearing in mind that this is an intensive agricultural production with the use of mechanization, the consumption of working time required for the production process is small. It is necessary to spend 5 working days per 1 hectare for corn production. For wheat production 3.5 days per hectare and for sunflower production 4 days per hectare.

11 For more details, see Božo Drašković, Zvonko Brnjas „Tržišna uslovljenost cena poljoprivrednih zemljišta“, in Ekonomske, socijalne i razvojne posledice prodaje poljoprivrednonog zemljišta u Srbiji, Institute of Economic Sciences, Belgrade, 2017, p.190.

Yields per chain are variable and the amplitude in the ratio of maximum and minimum is up to 5 times in corn, up to 1.6 times in wheat and in sunflower 2 times.

Table 4. Maximum and minimum yield

Crop yield per chain (0,57 acre)	Maximum tons	Minimum tons
Corn	7,5	1,5
Wheat	4	2,5
Sunflower	3	1,5

Source: Analysis is based an individual agricultural private farm in the Banat area

This oscillation of yield is conditioned by the distribution of precipitation. Because the owners' properties are not equipped with an irrigation system.

Table 5. Overview of basic costs and yields by crops

Investment in sowing per chain and yields by crops per chain

Investment Corn

	kg	Price in €
Seed	6	46
Fertilizer	200	80
Protective Equipment		50
Ploughing and prosessing		120
Sowing		47

Source: Analysis is based an individual agricultural private farm in the Banat area

Yield Corn

Yield in t	6
Price of ton €	128
Income €	769
Costs €	343
Net income €	426

Investment Wheat

	kg	Price in €
Seed	150	46
Fertilizer	400	160
Protective Equipment		50
Ploughing and prosessing		50
Sowing		47

Yield Wheat

Yield in t	4.5
Price of ton €	171
Income €	769
Costs €	353
Net income €	416

Investment Sunflower

	kg	Price in €
Seed	3	46
Fertilizer	400	160
Protective Equipment		50
Ploughing and prosessing		50
Sowing		47

Yield Sunflower

Yield in t	2.5
Price of ton €	308
Income €	769
Costs €	353
Net income €	416

Source: Analysis is based an individual agricultural private farm in the Banat area

The data presented in the table show that at maximum yields per chain, the financial effect by crops is relatively uniform. However, in bad years, net income decreases by an average of three times. Empirical analysis indicates exceptional income inelasticity of small agricultural producers.

Assuming that due to the crop rotation, 1/3 of the agricultural land is used annually for sowing each of the analyzed crops, which means that it expects a yield from each crop from an individual area of 11.66 chains.

The total average income per morning in the "best" year in terms of yield, per chain is approximately € 419. Empirically, the case analyzed here shows that the total annual income can be € 14,664 in terms of yields. The stated income, calculated on a family of four, shows an average of € 3,666 per year or on a monthly basis of € 305.

The total number of working days required for the work of farmers for 35 chains, i.e. 20 ha is 30 days per year for corn, 19 days for wheat and 24 days for sunflower.

Conclusion

Serbia has significant and diverse resources related to natural capital expressed through arable agricultural land. An important social and economic shock absorber is agricultural land from the point of view of maintaining the rural population, both in the plains and in mountainous areas. Serbia is an open market for competition of products of the agro-industrial complex from EU countries. Inequality in competition is caused by disproportions in subsidies allocated for primary agricultural production in EU countries and in Serbia. The empirical example analyzed in this paper indicates the economic and social unsustainability of the existing economic policy related to the primary agricultural production sector.

Literature

1. Census of Agriculture 2012 in the Republic of Serbia, Books I and II, RSZ Belgrade 2013.
2. Census of Agriculture 2012. RZS (Republic Bureau of Statistics).
3. *„Analiza pravnog i institucionalnog okvira tržišta poljoprivrednog zemljišta, procena ekonomskih efekata liberalizacije tržišta poljoprivrednog zemljišta i preporuka za izmene zakonodavnog i institucionalnog okvira i njihovu adekvatnu primenu,* „ Group of authors, Electronic edition p 50, GIZ Belgrade2016.
4. Prof. dr Miladin M. Ševarlić, *Poljoprivredno zemljište,* Republic Bureau of Statistics, Belgrade 2015.
5. Stela Strsoglavec, *Održivo upravljanje poljoprivrednim zemljištem,* Zborniku radova. *Ekonomske, socijalne i razvojne posledice prodaje poljoprivrednog zemljišta u Srbiji, Redaktor, Božo Drašković, Instituet of Economic Sciences Belgrade 2017.*
6. Božo Drašković, Zvonko Brnjas, *„Tržišna uslovljenost cena poljoprivrednog zemljišta*“, U Ekonomske, socijalne i razvojne posledice prodaje poljoprivrednog zemljišta u Srbiji, Institute of Economic Sciences Belgrade, 2017.

TRANSFORMATION FROM URBAN TO RURAL TOURISM DURING THE COVID-19 PANDEMIC: THE CASE OF SERBIA

Drago Cvijanović[1], Danijela Pantović[2], Nataša Đorđević[3]

Abstract

The COVID-19 pandemic led to the implementation of many restrictive measures to prevent it, which resulted in the decline in tourist arrivals and overnight stays. Due to the pandemic, various restrictive measures have also been applied in Serbia in order to prevent the spread of the virus e.g., banning the public gatherings, various restrictions for hotels, and restaurants, along with other measures. Although there is a decline in the number of tourist arrivals in Serbia during 2020, there is also a growing interest in rural tourism in Serbia. This paper examines whether there have been changes in travel plans in 2020 due to the pandemic, and whether urban or rural tourist destinations in Serbia or abroad are preferred during 2020. The data were collected by a survey, while their analysis and processing were done with the use of the Statistical Package for the Social Sciences (SPSS).

Key words: *rural tourism, Serbia, COVID-19, pandemic, tourist destination.*

Introduction

The COVID-19 pandemic affected all sectors. The consequences of a pandemic are not and will not be the same for all economies or in the entire global economy. Some sectors may benefit financially, while others will suffer immeasurably.

The problems are particularly bad in the tourism and hospitality sectors. The global tourism industry includes airlines, cruise companies, casinos, hotels, etc. All of these sectors face a reduction in activity of more than 90% globally (Fernandes, 2020). Many tourism destinations had less tourists then before, airlines are canceling flights and staffing, trade fairs and cruises have been canceled, and hotels are being closed. In addition to these, there are other

1 Drago Cvijanović, Ph.D., Full Professor, Faculty of Hotel and Tourism Management, University of Kragujevac, Vojvođanska Street no. 5A, 36210 Vrnjačka Banja, Serbia, E-mail: drago.cvijanovic@kg.ac.rs

2 Danijela Pantović, M.Sc., Teaching Assistant, Faculty of Hotel and Tourism Management, University of Kragujevac, Vojvođanska Street no. 5A, 36210 Vrnjačka Banja, Serbia, Phone: +381 64 580 65 99, E-mail: danijela.durkalic@kg.ac.rs

3 Nataša Đorđević, M.Sc., Teaching Assistant, Faculty of Hotel and Tourism Management, University of Kragujevac, Vojvođanska Street no. 5A, 36210 Vrnjačka Banja, Serbia, Phone: +381 62 123 61 41, E-mail: natasa.djordjevic@kg.ac.rs

companies that rely on and directly or indirectly depend on tourism and suffer the negative effects of this situation.

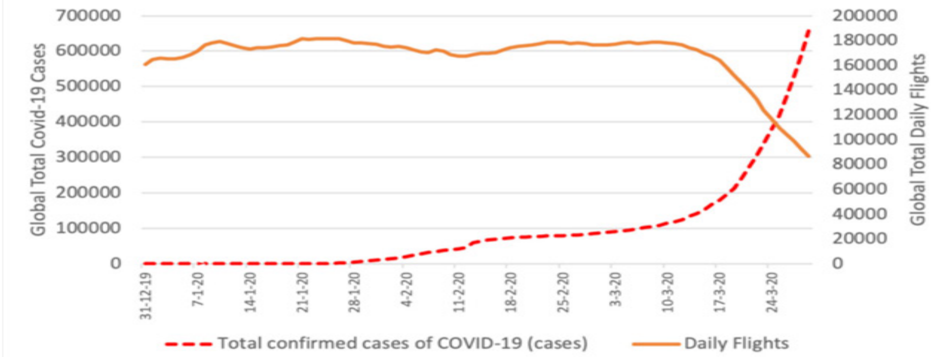
In 2020, World Tourism Day is marked by the unique role that tourism has in providing opportunities for travel outside the big cities in the function of preserving cultural heritage entitled "Tourism and Rural Development". Countries around the world expect rural tourism to boost tourism recovery from the COVID-19 pandemic, including rural areas that are a key economic pillar of development this year.

The subject of the paper refers to the intentions to travel for tourist purposes during 2020 and the COVID-19 pandemic. The aim is to investigate whether there have been changes in travel plans during 2020 due to the outbreak of the pandemic in the Republic of Serbia. In addition, the authors pay special attention to examining whether urban or rural tourism destinations in Serbia or abroad are preferred during 2020.

Literature review

The global decline in international travel caused by the COVID-19 pandemic led to a loss of 440 million international arrivals in the period January-June 2020, whose losses are estimated at about 460 billion US dollars. This loss is five times higher than the exports of international tourism recorded in the crisis of 2009. With the increase in the number of COVID-19 infected people, the number of global flights has dropped dramatically - Figure 1 (Gössling et al., 2020).

Figure 1. Daily global COVID-19 cases and global flights.



Source: Gössling et al., (2020).

According to the World Tourism Organization (UNWTO), international tourist arrivals fell by 93% in June 2020 compared to the same period in 2019.

These data show a serious impact of COVID-19 on the tourism sector. Serious multidisciplinary problems have been caused in whole world. Most countries around the world have closed their borders and imposed travel restrictions. (UNWTO, 2020). However, since September 2020, 53% of destinations have induct a travel ban.

In 2019, the number of international tourists in the world increased by 4%, while in the period from January to March 2020, it decreased by 22%. In Europe, this decline is by 19%, in the Asia-Pacific region by 35%, in America by 15%, Africa by 13% and the smallest decline in international tourist arrivals was recorded in the Middle East - 11% (Figure 2) (UNWTO, 2020).

In Republic of Serbia, according to the data of the Republic Statistical Office, in August 2020, compared to August 2019, the number of tourist arrivals decreased by 34.3%, while the number of overnight stays decreased by 17.1%. The number of domestic tourist arrivals increased by 25.3% while the number of arrivals of foreign tourists decreased by 87.1% (Statistical Office of the Republic of Serbia, 2020). In the first 5 months of 2020, the total number of tourist arrivals in Serbia decreased by 52.8% compared to the same period in 2019 (Ministry of Trade, Tourism and Telecommunications of the Republic of Serbia, 2020). To travel abroad during 2020 became uncertain, as a result of that there is an increase in domestic tourists in Serbia. Also, in 2020 there is a tendency of growing interest for rural tourism in Serbia (BBC News, 2020)

As Dimitrovski et al. (2019) state, agritourism has received growing academic interest over the recent decades. In general, tourism and agriculture significantly contribute to the development of the economy, especially those at the local level. Most countries record faster growth of tourism in the presence of agricultural societies, especially those countries in which tourism is the first or second source of income from exports (Sanches-Pereira et al., 2017). Despite the strong impact of the pandemic on the tourism market and stopping tourist arrivals, a solution to revive tourism in some countries has been found in rural tourism. As part of the overall tourism supply, in rural areas should be included agritourism, which is an important way to diversify agriculture and rural areas. In addition, it is part of the idea of sustainable and multifunctional agriculture (Wojcieszak-Zbierska, 2020). As pointed out in research about tourism during the COVID-19 pandemic, it is necessary not only to return into the previous state when the crisis is over, but to find the possibility of transforming global tourism that will be more aligned to the sustainable development goals (Brouder, 2020; Gössling et al., 2020; Hall et al. 2020; Nientied, & Shutina; 2020).

Methodology

The following research questions were drawn in the paper:

- what are the intentions for traveling during 2020 in Serbia?
- what type of destination is preferred during 2020 – urban or rural?

In accordance with the subject and the aim of the paper, a quantitative method was used. The primary data are collected using a survey method on the territory of the Republic of Serbia. The questionnaire was developed on the basis of researches of Kourgiantakis, et al., (2020), Öcal, (2020) and Monterrubio, et al., (2018). It consisted of two parts. The first part included socio-demographic questions such as gender, age, education, marital and parental status, also their income level. The second part consisted of 6 questions related to the intentions of the respondents for traveling during.

Respondents could choose one of the offered answers on each question. The research was conducted during September 2020. Questionnaires were distributed in the form of a Google questionnaire. A total of 430 valid responses were collected. Participation in completing the questionnaire was voluntary and anonymous. Respondents who completed the survey are from Serbia. For the purpose of the processing of collected data, descriptive statistical analysis: frequency and percentages were used in order to describe the research sample and answers about respondents' intentions for traveling.

Analysis of results

Out of 430 respondents, 370 (86%) are female and 60 (14%) male. Respondents aged 20-30 years have the highest participation in the sample (42.3%), then those who belong to the age group 31-40 (29.3%). When it comes to the education level of respondents, the largest number belongs to the category of respondents that have a bachelor`s degree (37.4%) and in the second place high school graduates (28.6%). Most of them are married (55.1%) and parents (52.8%). The largest number of respondents stated that their income level is 30.000-60.000 RSD (28.1%), but there are even 20.9% of respondents who did not want to state about their income level (Table 1.).

Table 1. Demographic characteristic

		Frequency	Percent	Valid Percent	Cumulative Percent
Gender	Male	60	14.0	14.0	14.0
	Female	370	86.0	86.0	100.0
	Total	430	100.0	100.0	
Age	20-30	182	42.3	42.3	42.3
	31-40	126	29.3	29.3	71.6
	41-50	86	20.0	20.0	91.6
	51-60	27	6.3	6.3	97.9
	> 60	9	2.1	2.1	100.0
	Total	430	100.0	100.0	
Education	High school graduate	123	28.6	28.6	28.6
	Vocational degree	30	7.0	7.0	35.6
	Bachelor's degree	149	34.7	34.7	70.2
	Master degree	65	15.1	15.1	85.3
	Doctoral degree	63	14.7	14.7	100.0
	Total	430	100.0	100.0	
Marital status	Married	237	55.1	55.1	55.1
	Single	155	36.0	36.0	91.2
	Other	38	8.8	8.8	100.0
	Total	430	100.0	100.0	
Parental status	Parent	227	52.8	52.8	52.8
	Non-parent	203	47.2	47.2	100.0
	Total	430	100.0	100.0	
Income level	Up to 30.000 RSD	73	17.0	17.0	17.0
	30.000-60.000 RSD	121	28.1	28.1	45.1
	60.000-90.000 RSD	71	16.5	16.5	61.6
	90.000-120.000 RSD	39	9.1	9.1	70.7
	More than120.000 RSD	36	8.4	8.4	79.1
	I do not want to state	90	20.9	20.9	100.0
	Total	430	100.0	100.0	

Source: Authors based on research

The first question in the second part of the questionnaire is about holiday traveling intention. Most of the respondents stated that they had no *holiday traveling intention* at all during 2020 (37.7%), while 28.4% stated that they *intent to travel but not sure when*. When it comes to time when the intent to travel respondents chose almost equal that they want to travel *after summer untill the end of the year* (14.9%) and *during summer* (14%). Some respondents chose *other* as answer (5.1%), and this might mean that they have already traveled during 2020 (Table 2).

Table 2. Holiday traveling intention

Holiday traveling intention	Frequency	Percent	Valid Percent	Cumulative Percent
Intent to travel but not sure when	122	28.4	28.4	28.4
Traveling during summer period	60	14.0	14.0	42.3
Traveling after summer period until the end of the year	64	14.9	14.9	57.2
None traveling intention	**162**	**37.7**	**37.7**	**94.9**
Other	22	5.1	5.1	100.0
Total	430	100.0	100.0	

Source: Authors based on research

Considering the global pandemic during the 2020, the aim of the next question is to examine what happened with the traveling plans of the respondents. The largest number - 230 respondents or 53.5% stated that they *had no changes in plan* and 20.9% choose *other* as answer. 15.8% have *canceled their holiday plan* and 9.8% are *not sure yet* (Table 3).

Table 3. Changes in holiday plans during 2020

If you intended to travel during 2020, and still didn't, what happened with your holiday plans	Frequency	Percent	Valid Percent	Cumulative Percent
Not sure yet	42	9.8	9.8	9.8
Cancelation of holiday plans	68	15.8	15.8	25.6
No changes in plan	**230**	**53.5**	**53.5**	**79.1**
Other	90	20.9	20.9	100.0
Total	430	100.0	100.0	

Source: Authors based on research

The answers on the next question show that 42.3% of respondents included *Serbia* as their holiday destination in 2020. Even 27% of respondents chose destination *abroad* which is still great number, considering that many borders are closed due to pandemic in 2020. On the other side 25.1% *have canceled their holiday and decided to stay home*, which is on the other side less than number of the respondents who chose to travel to Serbia and abroad. Only 5.6% chosed *other* as an option for their holiday plan in 2020 (Table 4).

Table 4. Holiday plans in 2020

My holiday plan in 2020 is:	Frequency	Percent	Valid Percent	Cumulative Percent
Serbia	**182**	**42.3**	**42.3**	**42.3**
Abroad	116	27.0	27.0	69.3
I canceled my holiday, I m staying home	108	25.1	25.1	94.4
Other	24	5.6	5.6	100.0
Total	430	100.0	100.0	

Source: Authors based on research

Respondents for holiday plan for the period after pandemic is over chose *Serbia* (45.6%). For *Europe* (19.1%) and for *Outside of Europe continent* (3.5%) opted fewer respondents (in total 23,6%) than for traveling abroad in 2020 (27%). On the other side 24.2% of respondents *gave up on traveling even after pandemic* is over. For option *other* opted 7.7% which might be because of their uncertain plans (Table 5).

Table 5. Plans after the end of pandemic

My holiday plan after the end of COVID 19 pandemic is to travel to:	Frequency	Percent	Valid Percent	Cumulative Percent
Serbia	196	45.6	45.6	45.6
Europe	82	19.1	19.1	64.7
Outside of the Europe continent	15	3.5	3.5	68.1
I gave up on traveling, I m staying home	104	24.2	24.2	92.3
Other	33	7.7	7.7	100.0
Total	430	100.0	100.0	

Source: Authors based on research

On the basis on the answers for the two previous question Serbia is the destination that most of the respondents would choose for their travel during 2020 and after the pandemic is over. This might be justified with the fact that also most of them, even 70.2% of them believe that Serbia is safe tourism destination during pandemic (Table 6).

Table 6. Serbia as safe destination during pandemic

I believe that Serbia is a safe tourism destination during COVID 19 pandemic	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	302	70.2	70.2	70.2
No	128	29.8	29.8	100.0
Total	430	100.0	100.0	

Source: Authors based on research

When it comes to intention to travel to urban or rural destination in Serbia or abroad, over 50% of the respondents opted for rural and 15.8% of the respondents for urban in tourism destination Serbia. But the ones who decided for destinations abroad opted more for urban (21.6%) than for rural tourism destination (7.7%) (Table 7).

Table 7. Preferred type of tourism destination in 2020

What type of tourism destination would you choose in 2020?	Frequency	Percent	Valid Percent	Cumulative Percent
Urban tourism destination in Serbia	68	15.8	15.8	15.8
Rural tourism destination in Serbia	236	54.9	54.9	70.7
Urban tourism destination abroad	93	21.6	21.6	92.3
Rural tourism destination abroad	33	7.7	7.7	100.0
Total	430	100.0	100.0	

Source: Authors based on research

Conclusion

There is no doubt that tourism is an important source of income and a significant factor in economic stability; tourism contributes to an increase in foreign exchange inflows and job creation (Dašić & Vujić, 2020). It is clear that this crisis will last for several months. Government and members of the public sector will be very careful when removing the bans. It is very likely that countries such as Italy, Spain and France will be very careful when they reopen their borders, as long as a fear of re-infection exist. During September 2020, officials claim that the peak of the pandemic has passed. However, most people believe that it will take months before the economy returns to normal. The spread of the virus creates fear of a global recession, which further reduces the demand for products. The latest data show that industrial production in 2020 fell by more than 13.5%. (Fernandes, 2020).

Analyzing the recent effects of the COVID-19 pandemic may be relevant to national and international agencies. Also, this results can be used for health planning. The analysis shows that the travel restrictions was initially effective in reducing international "imports of positive cases", and restrictions increased domestic tourism, especially in rural areas. All this is due to the fact that these areas have small population density, the air is cleaner and the risk of infection is minimal.

This study shows that the majority of respondents do not intend to travel during 2020 and COVID-19 pandemic. Also, most of the respondents did not change their travel plans during the pandemic. Serbia is a preferred destination to travel in 2020 and most of the respondents want to visit rural tourism destinations in Serbia. A large number of respondents believe that Serbia is a safe tourism destination during the COVID-19 pandemic, and even after the end of the COVID-19 pandemic, most respondents plan to travel around Serbia. Considering that respondents are from Serbia, it can be concluded that a chance for tourism in Serbia during the crises might be in domestic rural tourism. In the future, restrictions on travel to and from areas affected by COVID 19 are expected to have modest effects. This would mean that earlier interventions are expected to give greater benefits to ease the pandemic.

Literature

1. BBC News (2020): Retreived from: https://www.bbc.com/serbian/lat/svet-53477801 (September 15, 2020).
2. Brouder, P., 2020: Reset Redux: Possible Evolutionary Pathways Towards the Transformation of Tourism in a COVID-19 World. *Tourism Geographies*, first published 6 May 2020, DOI: 10.1080/14616688.2020.1760928
3. Dašić, D. R., & Vujić, T. (2020): Rural tourism in development function of rural areas in Serbia. *Economics of Agriculture*, 67(3), 719-733. doi: https://doi.org/10.5937/ekoPolj2003719D .
4. Dimitrovski, D., Leković, M., & Joukes, V. (2019): A bibliometric analysis of Crossref agritourism literature indexed in Web of Science. *Hotel and Tourism Management*, 7(2), 25 - 37. https://doi.org/10.5937/menhottur1902025D
5. Fernandes, N. (2020): Economic effects of coronavirus outbreak (COVID-19) on the world economy. *Available at SSRN 3557504*.

6. Gössling, S., Scott, D., & Hall, C. M. (2020): Pandemics, tourism and global change: a rapid assessment of COVID-19. *Journal of Sustainable Tourism*, 1-20.
7. Hall, C.M., Scott, D. & Gössling, S., 2020: Pandemics, Transformations and Tourism: Be Careful What You Wish for. *Tourism Geographies*, first published 28 April, DOI: 10.1080/14616688.2020.1759131.
8. Kourgiantakis, M., Apostolakis, A., & Dimou, I. (2020): COVID-19 and holiday intentions: the case of Crete, Greece. *Anatolia*, 1-4.
9. Ministry of Trade, Tourism and Telecomunication of the Rebuplic of Serbia (2020): Retreived from: https://mtt.gov.rs/en/ (September 15, 2020).
10. Monterrubio, C., Osorio, M., & Benítez, J. (2018): Comparing enclave tourism's socioeconomic impacts: A dependency theory approach to three state-planned resorts in Mexico. *Journal of destination marketing & management*, 8, 412-422.
11. Nientied, P.; & Shutina, D. (2020): Tourism in Transition, the post Covid-19 Aftermath in the Western Balkan. *Co-PLAN Resil. Ser.* 2, 1–20.
12. Öcal, A., Cvetković, V. M., Baytiyeh, H., Tedim, F. M. S., & Zečević, M. (2020): Public reactions to the disaster COVID-19: a comparative study in Italy, Lebanon, Portugal, and Serbia. *Geomatics, Natural Hazards and Risk*, *11*(1), 1864-1885.
13. Sanches-Pereira, A., Onguglo, B., Pacini, H., Gómez, M. F., Coelho, S. T., & Muwanga, M. K. (2017): Fostering local sustainable development in Tanzania by enhancing linkages between tourism and small-scale agriculture. *Journal of Cleaner Production*, *162*, 1567-1581.
14. Statistical Office of the Republic of Serbia (2020): Retreived from: https://www.stat.gov.rs/vesti/20200930-turisticki-promet-avgust-2020/?s=2202 (September 15, 2020).
15. UNWTO, (2020): International Tourist Numbers Down 65% in First Half of 2020, UNWTO Reports,. Retreived from: https://www.unwto.org/taxonomy/term/347 (September 15, 2020)
16. Wojcieszak-Zbierska, M. M., Jęczmyk, A., Zawadka, J., & Uglis, J. (2020): Agritourism in the Era of the Coronavirus (COVID-19): A Rapid Assessment from Poland. *Agriculture*, *10*(9), 397.

PROTEIN CONTENT IN BEAN GRAIN GROWN ACCORDING TO SUSTANABLE ECOLOGICAL PRINCIPLES

Gordana Dozet[1], Marijana Jovanović Todorović[2], Mirjana Vasić[3], Vojin Đukić[4], Marija Cvijanović[5], Zlatica Miladinov[6], Gorica Cvijanović[7]

Abstract

The research has been conducted during a three-year period in order to determine the protein content in bean grains grown by organic principles and to choose more suitable variety for farming in organic production. The field experiment was set by a split-plot design in 4 repetitions on calcareous chernozem. The large plots were cropped with varieties Maksa and Zlatko, while control subplot was treated by agro-technical treatments permitted in organic production. In the research, the starting hypothesis was that the protein content in bean grains will depend on variety and applied agro-technics in organic bean growing technology. The protein content in bean grain was statistically significantly dependent on agro-ecological conditions during the production year, variety and applied agro-technics. For the production of bean by organic principles, Maksa variety is recommended. It is possible to achieve high protein content in beans grown in accordance with the principles of sustainable ecological development.

Key words: *sustainable ecological development, beans, protein content.*

Introduction

Beans occupy an important place in the diet of our population, as a protein plant, but also in agricultural production, as an economically viable plant species and

1 Gordana Dozet, Ph.D., Associate Professor, Megatrend University, Faculty of Biofarming, Maršala Tita no. 39, 24300 Bačka Topola, Phone: +381 24 712 209, E-mail: gdozet@biofarming.edu.rs

2 Marijana Jovanović Todorović, M.Sc., Researcher Associate, Institute of Agricultural Economics, Volgina no. 15, 11060 Belgrade, Serbia, Phone: +381 60 484 80 41, E-mail: mairjana_j@iep.bg.ac.rs

3 Mirjana Vasić, Ph.D., Principal Research Fellow, Institute for crops and vegetables, Maksima Gorkog no. 30, 21101 Novi Sad, Serbia, Phone: +381 69 181 63 19, E-mail: mirjana.vasic@nsseme.com

4 Vojin Đukić, Ph.D., Senior Research Associate, Institute for crops and vegetables, Maksima Gorkog no. 30, 21101 Novi Sad, Serbia, Phone: +381 64 820 57 51, E-mail: vojin.djukic@nsseme.com

5 Marija Cvijanović, Ph.D., Assistant Professor, University Bijeljina, Pavlovića put bb, 76300 Bijeljina, Bosnia and Hercegovina, Phone: +381 63 885 81 85, E-mail: marijacvijanovic@yahoo.com

6 Zlatica Miladinov, Ph.D., Researcher Associate, Institute for crops and vegetables, Maksima Gorkog no. 30, 21101 Novi Sad, Serbia, Phone: +381 64 398 63 87, E-mail: zlaticamiladinov@gmail.com

7 Gorica Cvijanović, Ph.D, Full Professor, Megatrend University, Faculty of Biofarming, Maršala Tita no. 39, 24300 Bačka Topola, Serbia, Phone: +381 24 712 209, E-mail: cvijagor@yahoo.com

a good pre-crop. Due to its adaptability, it can be successfully grown in different agro-ecological conditions. It is one of the vegetables with the richest nutrients, primarily due to its high protein content.

Using the principles of organic agriculture, they combine the traditional way of production with the use of scientific innovations, all with the aim of promoting correct relations and a good quality of life within the environment. It is very important to choose the right variety that will be grown according to ecological principles (Vasić, 2016).

Modern agriculture is returning to organic agro-technical methods and the application of organic fertilizers. Guanito is a fertilizer based on bat droppings and part of seabirds. Contains all the macro and micro elements required by plants in their natural form. Declared organic fertilizers include Guanito, which contains 13% nitrogen, 8% phosphorus, 2% potassium and 11 trace minerals (Lazić and Šikoparija, 2011). It is an extraordinary organic fertilizer that has a beneficial effect on the positive balance of nutrients in the soil. It exhibits fungicidal and nematicidal properties (Shrinidhi et al., 2013).

Guanito faster mineralized itself, and plants get quickly available biogenic elements necessary to achieve planned and economically viable yields. Replacement of nitrogen from mineral fertilizers with organic and biological nitrogen has an ecological effect and has a positive effect on the physical properties of the soil.

Liquid preparation with effective microorganisms (EM aktiv) is applied before sowing for soil treatment and foliar. It promotes seed germination, lush roots, flowers and fruits and improves soil fertility (Szymanski et al., 2003). The tendency is to introduce into production varieties that are tolerant to diseases and pests, especially in the organic system of cultivation.

The implementation and maintenance of all the principles of organic cultivation technology implies the use of fertilizers for plant nutrition that are allowed in organic plant production. There are microorganisms that have a defensive role, but also a stimulating effect on plants. One of those organisms are fungi of genus Trichoderma spp. This fungi performes possitive effect on growth, development of plants, but also manifest preventive protection in case of pathogens attack (Harman et al., 2004).

Based on this research, we try to make a harmonized agricultural technique, especially in the organic system of cultivation. According to ressearch we can give a recommendation to target group of producers, in order to contribute to increasing the area under beans in the Republic of Serbia, as well as achieving stable yields with satisfying quality.

The aim of performed research is possibility to determine which variety is more adaptable to the conditions of organic sustainable production and which applied agrotechnics is better, but also the interaction between the examined factors that are determined on the protein content in bean grain. Also, the influence of weather conditions (years), different varieties and applied treatments on the organic pelleted fertilizer Guanita, *Trichoderma atroviride* (Tffi) and the microbiological preparation EM aktiv on the protein content in bean grain was observed.

Materials and Methods

Two beans varieties created on the Institute of Field and Vegetable Crops in Novi Sad, has been used as material in the field experiment. Used variety in experiment are variety's Maksa and Zlatko and both are of determinable growth. Organic pelleted fertilizer (Guanito) was used with the formulation of nutritive elements N:P:K = 6:15:3 + 10Ca + 2Mg. Effective microorganisms (EM-aktiv) and *Trichoderma atroviride* (preparation Tiffi) were applied. EM-aktiv is a liquid concentrate that holds main antibiotic organisms which can be found naturally in soil (more than 80 strains). The preparation contains firm body of aerobic and anaerobic microorganisms, without any traces of genetically modified microorganisms. *Trichoderma atroviride* represents an integral part of the commercial bio preparation Tiffi which serves to control pathogenic fungi.

The field experiment in dry vegetable farming was set on calcareous chernozem in the period of 2014-2016 in Bajša, municipality of Bačka Topola, by split-plot design in four repetitions. The preceding crop was onion. The first factor of examination was the year of research, the second (large plots) were varieties (Zlatko and Maksa), and the third factor (subplots) was fertilization with 5 treatments: 1 – control, 2 – treatment of soil using the EM-aktiv (7 days prior to sowing), 3 – treatment of soil using the *Trichoderma atroviride* (Tiffi) (7 days prior to sowing), 4 – treatment of soil with pelleted organic fertilizer Guanito + EM-aktiv (7 days prior to sowing) during the bean's blossoming and 5 – treatment of bean seeds immediately before sowing with *Trichoderma atroviride* (Tiffi).

After soil treatment by raking were fertilizer and preparations inserted into the sowing layer depth. Bean was manually sown in four five-meter-long rows. The first and the fourth row were used for isolation, and the two middle rows were used for sample collection of plants for further analysis. The size of the elementary plot was 10 m^2.

In their physiological maturity, the plants from the middle rows were cut underneath the cotyledonal scar with vineyard scissors, carefully tied in bundles and the grains were manually detached from pods for determining the yield. A mass of 100 g was submitted to the Institute of Field and Vegetable Crops to determine the protein content of beans. The results were processed in Statistica 12 for the split-plot experiment design, by using the variance analysis, until the average values were tested using t - test with significance level of 5% and 1%.

Weather conditions

Temperature and precipitation data were obtained from the valid meteorological station of the Agricultural Administrative and Professional Service Bačka Topola from Bačka Topola.

Temperatures for the bean's vegetation period have deviated from the perennial average – more than 1°C in the year 2015 and 0.8°C in in the year 2016, but in the year 2014, the temperature was below average for the same period when compared with the perennial average. Precipitation in 2014 was highest during the bean's vegetation period and it amounted to 371.2 mm, which was higher when compared with other examined years and the perennial average.

When compared with 2015, it was 208.3% higher, and when compared with 2016 it was 99.6% higher, while when compared with the perennial average it was 48.5% higher (Tab.1). On that basis, it was concluded that the year 2014 was the most favorable among the three examined years for bean growing without irrigation.

Tabele 1. Weather conditions during the vegetation period of bean

Precipitation/Temperature	Vegetetion period				
	May	June	July	August	Sum/ Average
Precipitation 2014	168.0	48.0	88.2	67.0	371.2
Precipitation 2015	18.4	20.4	15.0	66.6	120.4
Precipitation 2016	31.2	66.4	26.6	61.8	186.0
Perennial precipitation average (1962-2016)	65.4	69.4	61.6	53.6	250.0
Temperature 2014	15.6	20.0	21.9	20.7	19.6
Temperature 2015	17.4	20.6	24.1	23.8	21.5
Temperature 2016	17.1	22.2	23.9	21.7	21.2
Perennial temperature average (1962-2016)	17.2	20.5	22.2	21.6	20.4

Source: Meteorological yearbook - climatological data (2014-2016); Republic Hydrometeorological Service of Serbia; *- expressed in mm; **- expressed in °C

Research results with discussion

The average protein content in the research period 2014-2016 was 20.56% (Tab. 2), with the highest recorded protein content being 23.56% in 2014 for the variety Maksa in variant 5, and the lowest 17.03% in 2015 for varieties Zlatko in the control variant.

The highest protein content was in 2014 (22.47%), and the lowest in 2015 (18.79%), while in 2016 it was 20.42%. All differences in protein content measured in bean grain in the years of research were at the level of high ($p < 0.01$) statistical significance (Tab. 2). In the examined varieties, there were differences in the protein content in the bean grain. The Maksa variety had a significantly higher protein content (21.05%) compared to the Zlatko variety (20.07%). That was 4.88% more.

In the control variant, a lower protein content was measured (19.37%), which was statistically very significant ($p < 0.01$) compared to other variants used (20.95%, 20.84%, 20.56%), 21.08%), while between the applied variants from 2 to 5 there were no statistically significant differences in the mentioned measurement property.

The BxC interaction was significant, insofar as in both tested cultivars the lowest protein content was in the control, and the highest in variant 5.

The CxB interaction was significant only in the control variant, because the Zlatko cultivar had a significantly lower protein content compared to the Maksa cultivar.

Table 2. Influence of research factors on grain protein content (%)

Year (A)	**Variety (B)**	**Fertilization (C)**						**x̄A**
		1	**2**	**3**	**4**	**5**	**x̄AB**	
2014	Zlatko	20.37	22.42	22.47	21.89	22.51	21.93	22.47
	Maksa	21.97	23.38	23.08	23.03	23.56	23.00	
	x̄AC	21.17	22.90	22.78	22.46	23.03		
2015	Zlatko	17.03	18.75	18.79	18.31	18.82	18.34	18.79
	Maksa	18.37	19.55	19.31	19.26	19.70	19.24	
	x̄AC	17.70	19.15	19.05	18.79	19.26		
2016	Zlatko	18.52	20.38	20.43	19.90	20.46	19.94	20.42
	Maksa	19.97	21.25	20.99	20.94	21.42	20.91	
	x̄AC	19.24	20.82	20.71	20.42	20.94	x̄B	
x̄BC	Zlatko	18.64	20.52	20.56	20.03	20.60	20.07	
	Maksa	20.10	21.39	21.12	21.08	21.56	21.05	

Year (A)	Variety (B)	Fertilization (C)						$\bar{x}$A
		1	2	3	4	5	$\bar{x}$AB	
	$\bar{x}$C	19.37	20.95	20.84	20.56	21.08		
Average 2014 -2016								20.56
LSD A		Faktor						
		B	C	AxB	AxC	BxC	AxBxC	
p<0.05		0.09	0.57	0.66	0.69	1.02	0.95	1.54
p<0.01		0.15	0.86	0.88	1.04	1.36	1.27	2.06

Source: Current research results

The protein content is influenced by the weather conditions that characterized the production year for beans, the choice of variety, but also the application of specific agricultural techniques (certain treatments) before sowing and during the growing season. Similar results state Dozet (2006, 2009), Cvijanović et.al. (2016), Dozet et al. (2020). In 2014, when there was the most precipitation and when the highest yield per hectare was, then the highest protein content in bean grain was measured, by 11.86%, respectively 10.04%, compared to 2015 and 2016. Differences between cultivars existed, which indicates that the property of protein content is also defined by genetic influence. Such results in the examination of protein content in soy are reported by Dozet (2009). According, in a three-year study, the protein content was higher in the grain of the Maksa variety, which also had a higher yield compared to the Zlatko variety. In their research in Argentina, Sammán et al. (1999) have come to similar results, and found differences in the protein content between different varieties of beans in the interval from 18 to 22%. Different protein content between cultivars was also found in soybeans by Đukić et al. (2018). Similar results in a study of 106 wild and 99 primitive varieties of beans are reported by Gepts et al. (1986). The positive impact of microbiological preparations in their research is stated by Dozet et al. (2015, 2016).

Conclusions

Based on the examination of the influence of the year of the variety, organic fertilizer and microbiological preparations on the protein content in beans (*Phaseolus vulgaris* L.) grown according to ecological principles, the following can be concluded:

- The protein content was very significantly influenced by the examined factors, years, variety and application of Guanite, EM aktiv and Trichoderma.

- The interactions that were significant were BxC and CxB, while the others were not statistically significant.
- The average protein content in the research period 2014-2015 was 20.56%, with the highest recorded protein content being 23.56% and the lowest 17.03%. The highest protein content was in 2014 (22.47%) and the lowest in 2015 (18.79%).
- All differences between the years were at a level of high statistical significance. - In the control and the other 4 variants, there were very significant differences between the examined varieties with the correct trend, because in all variants the Maksa variety achieved higher protein content in the grain compared to the Zlatko variety.

Modern agriculture is returning to organic agrotechnical methods and the application of organic fertilizers, which includes Guanito fertilizer.

To determine the most optimal period for production, it is necessary to use the findings on the impact of climate change on the behavior of cultivated plants in the initial stages of growth, as well as on the quality of the obtained grain. In that way, it will be possible to adapt to the new conditions, as well as production in the months with the smallest moisture deficit.

For the determination of efficient agricultural system is crucial to understanding the agroecosystem. The future in the production of healthy food lies in the application of agronomic and environmental performance, while preserving water and the environment, as well as protecting the environment.

The key for determined most efficient farming systems lies in understanding how agroecosystems works. For the future production of healthy food it is necessary to perform ecological principles and that is produced according to ecological principles and unequivocally affects the protection of water, the environment, as well as the environment and humanity. It is possible to achieve high protein content in beans grown according to the principles of sustainable ecological development.

Literature

1. Cvijanović M., Dozet G., Cvijanović G., Đukić V., Vasić M., Popović V., Jakšić S. (2016): *Yield of Bean (Phaseolus vulgaris) in ecological production according to environment conservation*. VI Balkan Symposium on Vegetables and Potatoes (September 29, 2014 - October 2, 2014) - Acta Horticulturale 1142_4, 25-30.

2. Dozet Gordana (2006): *Prnos i kvalitet soje u zavisnosti od međurednog razmaka i grupe zrenja u uslovima navodnjavanja*. Magistarska teza. Poljoprivredni fakultet, Univerziteta u Novom Sadu, str. 73.
3. Dozet Gordana (2009): *Uticaj đubrenja predkulture azotom i primene Co i Mo na prinos i osobine zrna soje*. Doktorska disertacija. Fakultet za biofarming, Megatrend univerziteta, Beograd, str. 154.
4. Dozet G**.**, Cvijanovic G., Vasic M., Djuric N., Jaksic S., Djukic V., (2015): *Effect of microbial fertilizer application on yield of bean (Phaseolus vulgaris L.) in organic production system*. Proceedings of XXIII International Conference »Ecological Truth«, 17-20 June 2015, Kopaonik, Serbia, 105-107.
5. Dozet G**.**, Cvijanovic G, Jaksic S., Djukic V., Kaludjerovic D., Miladinov Z. (2016): *Impact of Trichoderma atroviride and effective microorganisms the yield of pepper (Capsicum annuum L.) in the greenhause.* Symposium proceedings 2nd International Symposium for Agriculture and Food ISAF 2015, Org. Fac. Of Agricultural Sciences and Food Ss "Cyril and Methodius" University in Skopje Rep. of Macedonia Ohrid, Republic of Macedonia. 7-9 October 2015, 295-300.
6. Dozet Gordana, Mirjana Vasić, Gorica Cvijanović, Vojin Đukić, Zlatica Miladinov, Nenad Đurić and Vladan Ugrenović (2020): *Effect of variety on bean yield in organic production*. Of GEA (Geo Eco-Eco Agro) International Conference - Book of Proceedings, 28-29 May 2020, Podgorica, Montenegro, 380-386.
7. Đukić V., Stojanović Danijela, Miladinov Zlatica, Miladinbović J., Balešević-Tubić Svetlana, Dozet Gordana, Merkulov-Popadić Larisa (2018): *Sadržaj proteina i ulja u novim NS sortama soje*, Zbornik radova 59. Savetovanje Proizvodnja i prerada uljarica, 17-22.
8. Gepts P., Osborn T.C., Raska K. Bliss F.A. (1986): *Phaseolin protein variability in wild forms and landraces, of the common (Phaseolys vulgaris L): Evidence for multiple centres of domestication*. Econ. Bot., 40: 451-468.
9. Harman G.E., Howell C.R., Viterbo A., Chet I., Lorito M. (2004): *Trichoderma species-opportunistic avirulent plant symbionts*. Nature Reviews Microbiology 2 (1): 43–56.
10. Lazić Branka i Šikoparija Dobrila (2011): *BIO-BAŠTA za Vas*. Centar za organsku proizvodnju, Selenča; Zelena mreža Vojvodine, Novi Sad, 92 i 96.

11. Sammán N, Maldonado S, Alfaro M.E, Farfán N., Gutierrez J. (1999): *Composition of different bean varieties (Phaseolus vulgaris) of Northwestern Argentina (Region NOA): cultivation zone influence*. J Agric Food Chem. 1999 Jul;47(7):2685-9.
12. Shrinidhi Shetty K.S., Sreepada Rama Bhat (2013): *Effect of bat guano on the growth of Vigna radiata L*. International Journal of Scientific and Research Publications, Volume 3, Issue 3, 1-8.
13. Szymanski N., Patterson Robert A. (2003): *Effective microorganisms (EM) and wastewater systems*, New England: University of New England (http://www.envismadrasuniv.org/pdf/effective%20microorganisms%20and%20waste%20water.pdf 06.09.2020, 16:10h).
14. Vasić M. (2016): *Sorte pasulja u različitim sistemima gajenja*. 50. Savetovanje agronoma i poljoprivrednika, 24.01. – 30.01.2016., Zlatibor (https://www.ifvcns.rs/wp-content/uploads/2016/03/17-Sorte-pasulja-u-razlicitim-sistemima-gajenja.pdf, 06.09.2020, 17:20h)

FINANCING AS DEVELOPMENT FACTOR IN THE HOP PRODUCTION AND BREWARY IN SERBIA

Gordana Radović[1], Radovan Pejanović[2], Zorica Vasiljević[3]

Abstract

The hop production in Serbia has been steadily declining since the Second World War. There were 1,500 hectares under these plantations in 1960, 245 hectares in 2004, 70.6 hectares in 2009, and only 8 hectares in 2019. The reasons for such situation are numerous. The authors believe that the financing is a significant development factor of the hop production and brewing in Serbia. In order to increase the presence of hops in the fields, and thus provide domestic raw materials for the development of craft breweries, it is important to define adequate measures of domestic agricultural policy, as well as to quantitatively and qualitatively improve existing sources of funding.

Key words: *hop, development, sources of financing, agricultural policy, Serbia.*

Introduction

Hops were produced in Serbia on 10,000 hectares in the first half of the 20th century. In 1960, there were 1,500 hectares under hops in Vojvodina. According to the data of The Business Association for Industrial Plants, hops were produced on 245 hectares in 2004, and in the next five years the production was reduced by almost 75%, i.e. in 2009 hops were produced in Vojvodina on 70.6 hectares, and only 8 hectares in 2019.

The causes of such situation are numerous. In order to change the sowing structure in favor of industrial plants, which includes hops, adequate agricultural policy measures are needed. The cultivation of hops enables the development of the processing industry. Also, in order to develop the hops production, larger allocations from the agrarian budget are needed for its incentives.

1 Gordana Radović, Ph.D., Research Associate, Director "Dnevnik-Poljoprivrednik" AD Novi Sad, Bulevar Oslobođenja no. 81, 21000 Novi Sad, Serbia, Phone: +381 64 13 78 643, E-mail: gordana.radovic09@gmail.com

2 Radovan Pejanović, Ph.D., Full Professor, University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića no. 8, 21000 Novi Sad, Serbia, Phone: +381 63 600 217, E-mail: radovan.pejanovic0603@gmail.com

3 Zorica Vasiljević, Ph.D., Full Professor, University of Belgrade, Faculty of Agriculture, Nemanjina no. 6, 11080 Belgrade, Phone: +381 64 143 99 42, E-mail: vazor@agrif.bg.ac.rs

In the second half of the 20th century, agriculture in Serbia was treated as "initial energy" for the development of industry, but also as a "social shock absorber".To that end, the prices of agricultural products were underestimated in relation to the industrial ones, which was manifested in strong "price scissors", which squeezed out about five billion US dollars from agriculture in the 1990s (Radović, 2009. p. 20). All of the above mentioned significantly affected the underdevelopment of agriculture, the lack of accumulation, i.e. their own sources of financing, as well as the abandonment of growing traditional plant species, such as hops.

Problems in agricultural development

Agriculture is characterized by biological and socio-economic specifics. Biological specifics of agriculture are: high risks of agricultural production, seasonal character of agricultural production, lack of specialization in production, as well as low level of capacity utilization (Vasiljević, 1998, p. 15).

Agriculture in Serbia has been in a deep and comprehensive crisis for a quarter of a century. The most significant causes of the crisis are the lack of financial resources for simple as well as expanded reproduction. This resulted in a reduction in the volume of production, as well as a lag in the development of this economic activity. «All of the above mentioned was followed by the extinction of our villages» (Pejanović, 2016, p. 75).

Agrarian policy in Serbia in recent decades is characterized by frequent changes that have been conditioned by the invariably more dominant influence of the state or the market (Pejanović, 2006, p. 15). Frequent changes in agrarian policy have resulted in insufficient allocations for certain measures. The reason for that was the insufficiency of funds in the agrarian budget, ie in the frequent changes of measures of the agrarian policy, the policy of subsidizing certain crops, and thus hops.

The crisis of agrarian policy is also reflected in insufficient investments in irrigation systems, which adversely affects yields. Climate changes are the new challenge for our agricultural policy, which is lagging behind in taking measures and actions to prevent the catastrophic consequences of floods, droughts and other disasters affecting agriculture.

Financing from the Agrarian budget

Insufficient investments in hop production are the result, above all, of insufficient funds in the agricultural budget.The share of the Agrarian budget in the total state budget was about 4% in 2016 and in 2017, 3.7% in 2018, 4.2% in 2019, and 4.3% in 2020.

The most common sources of financing the construction of hop gardens in the previous period were, in addition to subsidies from the relevant Ministry, and loans from commercial banks. The amounts of subsidies from the relevant Ministry have been variable in the previous decades, but, above all, insufficient. Despite the low interest rates, the credit conditions for agricultural entities on the domestic banking market are unfavorable, primarily due to the short credit period and unfavorable loan guarantee conditions.

In the Agrarian budget for 2017, 150 million dinars were reserved for incentives for raising new perennial orchards, vines and hops, and in 2018 it was 180 million dinars, while in 2019 it was 411.211 million dinars, and in 2020 it is 238.198 million dinars (Pravilnik, 2017; Uredba 2018; Uredba, 2019; Uredba, 2020). For example, in 2017, the Rulebook on incentives for programs for improving competitiveness for investments in physical property of agricultural farms through support for raising perennial fruit, vine and hop plantations defines the maximum amount of incentives per incentive user in the amount of three million dinars. Of this amount, it is prescribed that two million dinars can be used for the purchase of planting material, 700 thousand dinars for the purchase of backrests for plantations, 200 thousand dinars for land preparation, and 100 thousand dinars for soil analysis (Pravilnik, 2017).

We believe that in order to provide prerequisites for the development of hop production, it is necessary to qualitatively change the measures of agricultural policy. In particular, it is necessary to increase the participation of investment measures, but also to provide a legal basis for the development of new long-term sources of financing for agriculture.

Proposals for the development of hop production

An important developmental assumption is the consistency of agricultural policy measures - a subsidy for raising hopes for, at least, a ten-year period. It is also important to provide investment financing - construction of hop gardens, construction of irrigation and drainage systems, construction of anti-hail nets, etc. At the same time, it would be good to introduce an obligation to insure hop plantations for agricultural holders benefiting from these subsidies.

In order to develop hop production and entrepreneurship in brewing in Serbia, it is necessary to provide favorable development loans. Therefore, it would be good to establish a specialized (development) agricultural bank in Serbia. Specialized (development) agricultural bank, in accordance with the proposed model, should unify all previous ways of lending to agriculture from the state budget. It is necessary that a specialized agricultural bank, in order to ensure quality placements, has quantitatively and qualitatively adequate sources of financing that are conditioned and harmonized with the specifics of agriculture (Radović, 2014, p. 93-94).

In order to provide favorable sources of financing for mini (kraft) breweries, and thus for the development of entrepreneurship in this sector in Serbia, loans placed by microcredit organizations are also needed.

Conclusion

In order to develop hop production in Serbia, and thus provide domestic raw materials for the development of brewing, it is necessary to: define adequate agricultural policy measures, quantitatively and qualitatively improve existing sources of financing, as well as define potential sources of financing this production.

Potential sources of financing hop production and development of entrepreneurship in brewing (opening a mini brewery) could be loans from specialized agricultural banks and microcredit organizations, which would be placed under favorable conditions, while respecting the specifics of this type of agricultural production. These are new financial institutions that should be included in the domestic financial system by passing the necessary laws.

Providing new quality sources of financing could be a significant development precondition. The development of this type of production, and entrepreneurship in it, would provide greater employment opportunities for residents of rural areas, as well as overall rural development.

Literature

1. Pejanović R. (2006): *Tržište, država, tranzicija i poljoprivreda*, Agroekonomika, Br. 34-35/2005-2006, str. 8-24.
2. Pejanović R. (2016): *O razvojnim problemima naše agroprivrede,* Tematski zbornik: Stanje i perspektive agroprivrede i sela u Srbiji, Naučno društvo ekonomista Srbije, Akademija ekonomskih nauka i Ekonomski fakultet u Beogradu, Beograd, str. 69-91.
3. Pravilnik o podsticajima i programima za unapređenje konkurentnosti za investicije u fizičku imovinu poljoprivrednog gazdinstva kroz podršku podizanja višegodišnjih zasada voćaka, vinove loze i hmelja, Službeni glasnik Republike Srbije, br. 37/2017.
4. Radović G. (2009): Magistarska teza: *Modaliteti finansiranja agrara u tranzicionom periodu*, Univerzitet u Novom Sadu, Ekonomski fakultet Subotica.

5. Radović G. (2014): *Finansiranje poljoprivrede u Republici Srbiji,* Monografija, Zadužbina Andrejević, Beograd.
6. Uredba o raspodeli podsticaja u poljoprivredi i ruralnom razvoju u 2018. godini, Službeni glasnik Republike Srbije br. 18/18, 66/18, 86/18 i 93/18).
7. Uredba o raspodeli podsticaja u poljoprivredi i ruralnom razvoju u 2019. godini, Službeni glasnik Republike Srbije br. 12/19, 29/19, 40/19, 57/19, 69/19, 80/19, 88/19 i 94/19.
8. Uredba o raspodeli podsticaja u poljoprivredi i ruralnom razvoju u 2020. godini, Službeni glasnik Republike Srbije br. 1/20, 13/20, 27/20, 52/20, 75/20, 106/20, 118/20, 124/20 i 140/20.
9. Vasiljević Z. (1998): *Ekonomska efektivnost investicija u poljoprivredi,* Monografija, Zadužbina Andrejević, Beograd.

ECONOMIC EFFECTS OF PLUM PLANTATION ESTABLISHMENT[1]

Jonel Subić[2], Marko Jeločnik[3], Lana Nastić[4], Jean Vasile Andrei[5]

Abstract

Plum is the most important fruit species in the Republic of Serbia both in terms of produced quantities and in the areas under plum plantations. In line with importance of this fruit species, the main objective of the paper is to determine the economic effects of investing in establishment of plum plantation at the 10 hectares. The analysis was performed based on the data gained from the farm of individual agricultural producer from the city of Čačak. Establishment of the plum orchard considers the use of the variety "Čačanska lepotica". Assessment of the investment effects has been done based on the use of dynamic methods for investment evaluation, while the analysis of the investment sensitivity under the conditions of risk was also performed. According to the obtained results, it could be concluded that the investment in plum orchard establishment is profitable.

Key words: *plum, plantation establishment, investment, risk.*

Introduction

Currently, the fruit farming is the most competitive agricultural sector in Serbia. According to the Competitiveness Index, within the group of ten the most competitive agricultural products in Serbia, six are the fruits, primarily stone fruits and raspberry. The competitiveness of stone fruit (e.g. sweet and sour cherries, plums, apricots, etc.) derives from the fact that some of countries worldwide are giving up the production of mention fruit species for various reasons, affecting by this the reduction of competition within the observed sub-sector of fruit farming (SEEDEV, 2020).

1 This research was funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

2 Jonel Subić, Ph.D., Principal Research Fellow, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 69 72 863, E-mail: jonel_s@iep.bg.ac.rs

3 Marko Jeločnik, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 69 72 852, E-mail: marko_j@iep.bg.ac.rs

4 Lana Nastić, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 69 72 852, E-mail: lana_n@iep.bg.ac.rs

5 Jean Vasile Andrei, Ph.D., Full Professor, Petroleum-Gas University of Ploiesti, B-dul Bucuresti no. 39, Ploiesti, Prahova, Romania, Phone: +40 72 11 465 87, E-mail: andrei_vasile@yahoo.com

According to the SORS data (Table 1.), during the period 2012-2018., there have been came to increase in areas under the fruit production for around 12%, while in same time came to decrease in number of agricultural holdings involved in fruit farming for around 8.2%. The average area under the fruits per agricultural holding is around 0.7 ha. Majority of agricultural holdings that are growing the fruits, by their size, belong to the category of agricultural holdings that cultivate from 2 to 5 ha.

Table 1. Areas under orchards and number of agricultural holdings involved in fruit farming in Serbia (period 2012-2018.)

Descrip-tion	**2012.**		**2018.**		**Change in areas under orchards, index 2018/2012**	**Change in number of AH involved in fruit farming, index 2018/2012**
	Areas (in ha)	**AH (number)**	**Areas (in ha)**	**AH (number)**		
Orchards	163,310	295,203	182,923	270,890	112.0	91.8

Source: SORS, 2012; SORS, 2018.

The number of agricultural holdings specialized in fruit farming (56,285 holdings) is relatively small (around 10% of the overall number of agricultural holdings in Serbia, or around 20% of agricultural holdings involved in fruit farming).

According to FAOSTAT, Serbia is one of the countries with the largest areas under the plum orchards, as well as among the leaders in plum production within the Europe (during 2018., there were produced 430,199 tons of fresh plums in Serbia), (FAO, 2020).

By many elements, plum is the most represented and leading fruit species in Serbia. It is grown by nearly 200,000 agricultural holdings, on the area of 72,989 ha, what is around 40% of the total area under the orchards at national level (SORS, 2018).

Mentioned fruit specie is grown on the overall territory of Serbia. By the used areas and volume of production especially are known areas of the Western Serbia, Šumadija and part of Southern Serbia around municipality of Prokuplje (Keserović et al., 2014). Favourable conditions for development of plum farming are in hilly and mountainous regions with the altitude of up to 600 m, what fits to faster plant entry into the yielding, and enables higher yields (Trajčevski, 2008). Analysing the plum production in Serbia by regions, it could be noticed that the region Serbia-North is in deficit, while the region Serbia-South is in surplus by produced plums (Stevanović et al., 2018).

A large share of plum farming in Serbia is based on old and neglected orchards, characterized by alternative yielding and poor fruit quality, as well as with a planting density of around 400 seedlings/ha (SEEDEV, 2020). Due to late spring frosts and buds' freezing, or due to occurrence of hail and spring floods, plum yields significantly oscillate from year to year. In average, at national level plum yields are about 7 t/ha, or slightly above 10 t/ha in the best production years (Keserović et al., 2014).

In line to tradition, favourable climate and available natural resources, widespread processing activities (e.g. into the brandy, jams, dried plums, etc.), and other elements that attract the farmers to engage into this line of production, in previous years it has been noticeable that the extensive plum production is rapidly replacing with the semi-intensive and intensive systems of plum farming. There also comes to change in grown and used plums' varieties, where autochthonous varieties that are usually used in brandy production are replaced by the varieties such are "Čačanska lepotica", "Stanley" or "Čačanska rodna". Besides, it has also came to change in farming technology, i.e. it comes to increase in planting density (the number of seedlings increase up to 800-1,200 seedlings per hectare, reaching the overall yield of around 14 t/ha), while previously freely formed treetop is increasingly replaced with the modern growing forms, such as spindle treetop, etc. Nowadays, there are no modern plantations without implemented irrigation system (Keserović et al., 2014; SEEDEV, 2020). Of course, there are also certain problems that have been burdening the plums farming. The most important are the expressed sensitivity of the plant to the plum pox virus, still large share of varieties that are not matching the market requests, or presence of unsuitable shape of the treetop and inappropriate rootstock, as well as highly oscillating size of the fruits of table varieties (Duralija, 2002).

The largest part of produced plum (over 80%) is used in brandy production, while the rest is used for drying, freezing, or in jam and other confectionery productions. Small volume is consumed as a fresh product (MAFWM, 2019a; SEEDEV, 2020).

Prodanović (2015) had been analytically approached to the issue of profitability in growing of many fruit species, that are produced both in organic and conventional production systems. He founded that in conventional plum production it could be reached a profit of 3,174 EUR/ha, while in organic production the realized profit is lower and amounts 2,594 EUR/ha. Vukoje and Milić (2009) were made a comparative analysis of the economic effects derived from apple, pear and plum production. They have been determined that in Serbian conditions the most profitable is the pear production, while the weakest business results could be achieved in plum production. Similar results and conclusions had Lukac Bulatovic et al. (2017) who had dealt with the profitability of the production of certain fruit species (apples, pears, peaches, sour cherries and plums) in Vojvodina region. Based on the calculation of the contribution margins, they have been determined that the best business results are achieved in the pears farming, then apples growing, while the worst results were derived from plums farming.

Used Methodology

During 2020, at the territory of city of Čačak was conducted the research including the family agricultural holding that owns plum plantation. All for further economic analysis required data are collected through the in-depth interview with farm members.

In paper was analysed the profitability of investing in a new plum orchard, that has been established according to modern standards, with the use of irrigation system and anti-hail net, as well as with the purchased mechanization needed for the realization of activities in the orchard. In line to gained data from the agricultural holding, as well as available data from the local market, the economic effects of investment in plum plantation under the variety "Čačanska lepotica" were assessed by the use of dynamic methods for the investment evaluation. Evaluation includes next methods: Net Present Value (NPV), Internal Rate of Return (IRR) and Dynamic Payback Period (DPP), (Subić, 2010; Subić et al., 2013; Ivanović, Marković, 2018).

Besides, it was conducted the assessment of investment under the conditions of uncertainty by the use of break-even point method (method assumes determination of critical and minimal values of produced volume and sales incomes below which the investment is not economically justified), and margin of safety (it shows for how much percent the volume of sales or production can fall without going to a loss), (Subić, 2010).

Results and discussion

The plum orchard has been established on the area of 10 ha. It will be mostly in function of fresh plums selling at the local market while the smaller part of fruit production will be realized for processing into the brandy. For new orchard establishment was used the variety "Čačanska lepotica", as its fruits perfectly fits market requirements for fresh consumption, while it can be also successfully used for the brandy production. Planting density is 667 trees per hectare. As form of treetop was used the advanced pyramidal shape, that is the most common treetop form for plum in Serbia.

Besides the establishment of plum orchard with implemented irrigation system (with digging of proper draw well) and anti-hail protection, investment also includes the purchase of specialized mechanisation required in fruit production (small tractor, atomizer, roto-tiller, orchard shredder and tractor trailer), as well as establishment of wire fence around the orchard (purchase of concrete pillars and galvanized wire fence).

Investment was partly financed by own assets (49.17%), while the share of borrowed assets was 50.83% (annual interest rate on borrowed assets from the commercial bank is 6%). The loan will be repaid during the five years, while the grace period is two years. On the other hand, the interest rate calculated on invested farms' own assets is 2%.

Investment in plum orchard establishment considers the use of public incentives for the establishment of fruits' plantations, which amounts 50% of the overall investment costs. This incentive is used for the purchasing of certified seedlings, orchards' pillars, as well as for required land preparation activities towards the establishment of plum plantation, chemical analysis of soil related to determining its chemical composition and defining appropriate recommendations for the use of necessary fertilizers (Ordinance on incentives for programs towards the improvement of competitiveness, for investments in physical assets of agricultural holdings through the support of fruit, vine and hop plantations establishment), (MAFWM, 2019b). Previous research related to impact of overall incentives and share of incentives in the total investment in plum orchard establishment on achieved business results in BiH shows the significant impact of subsidies on business results of farms engaged in plum production (average share of incentives in overall investment in plums' plantation establishment was 14.3%), (Karić, Ćejvanović, 2004).

As was planned, a large part of the produced plums will be sold to the key buyer who will realized them later at the local market as fresh, while the certain volume of plums farm will realize in fresh condition through the local retail based on previously signed contracts. Smaller part of produced volumes of plum will be sold to local processors (for brandy production), or to individuals at farm gate.

In orchard will be engaged two farm members, while during the seasonal production peaks it will be additionally employed external labour.

In next table (Table 2.) are presented the total costs incurred over the years of investment implementation.

Table 2. Total expenditures (in RSD)

No.	Type of cost	Year of the investment realization				
		I	II	III	IV	V
I	**Material costs**	**385.043,09**	**687.542,22**	**975.753,78**	**892.840,89**	**924.249,49**
1.	Direct material	229.712,50	446.401,72	674.156,25	589.262,50	618.725,63
2.	Energy and fuel	155.330,59	241.140,50	301.597,53	303.578,39	305.523,87
II	**Non-material costs**	**4.936.842,74**	**4.953.271,24**	**5.613.507,43**	**5.380.922,49**	**5.135.763,68**
1.	Depreciation	1.917.557,26	1.917.557,26	1.917.557,26	1.917.557,26	1.917.557,26
2.	Labour	2.970.000,00	2.970.000,00	2.970.000,00	2.970.000,00	2.970.000,00
3.	Interest on the loan	0,00	0,00	636.340,20	405.355,44	160.196,63
4.	Other non-material costs	49.285,48	65.713,97	89.609,96	88.009,79	88.009,79
Total (I+II)		**5.321.885,84**	**5.640.813,46**	**6.589.261,21**	**6.273.763,37**	**6.060.013,17**

Source: IAE, Belgrade 2020.

The profit and loss statement (Table 3.) for entire period of investment implementation was presented according to total costs and formation of previously planned overal incomes. Assuming that investment in establishment of perennial plant plantations does not generate the significant incomes in initial years of investment realization, it is consired that in second and third year will be gained the loss (there is no loss in first year of the investment implementation due to received incentives and definied grace period). Over the years, with the increase in yields, due to plants maturing, there comes to growth in achieved profit, where the largest profit will be gained in fifth year of the investment implementation.

Table 3. Profit and loss statement (in RSD)

No.	Description	Year of the investment realization				
		I	II	III	IV	V
I	**Total Incomes**	**7.984.813,37**	**1.184.592,00**	**4.442.220,00**	**8.884.440,00**	**14.807.400,00**
1.	Incomes of products selling	0,00	1.184.592,00	4.442.220,00	8.884.440,00	14.807.400,00
2.	Incomes from incentives (subsidies)	7.984.813,37	0,00	0,00	0,00	0,00
II	Business expenses	**5.321.885,84**	**5.640.813,46**	**6.589.261,21**	**6.273.763,37**	**6.060.013,17**
1.	Material costs	5.321.885,84	5.640.813,46	5.952.921,01	5.868.407,93	5.899.816,54
1.1.	Non-material costs without depreciation and interest on the loan	385.043,09	687.542,22	975.753,78	892.840,89	924.249,49
1.2.	Depreciation	3.019.285,48	3.035.713,97	3.059.609,96	3.058.009,79	3.058.009,79
1.3.	Financial expenses	1.917.557,26	1.917.557,26	1.917.557,26	1.917.557,26	1.917.557,26
2.	Interest on the loan	0,00	0,00	636.340,20	405.355,44	160.196,63
2.1.	Business expenses	0,00	0,00	636.340,20	405.355,44	160.196,63
III	**Gross profit (I-II)**	**2.662.927,54**	**-4.456.221,46**	**-2.147.041,21**	**2.610.676,63**	**8.747.386,83**

Source: IAE, Belgrade, 2020.

In line to available investment data (investment value and model of financing), overal costs and production value, the net cash flow (Table 4.) and economic flow (Table 5.) were formed.

Table 4. Net cash flow (in RSD)

No.	Element	Initial moment	Year of the investment realization				
			I	II	III	IV	V
I.	**Total cash inflow (1+2+3)**	**21.079.907,31**	**7.984.813,37**	**1.184.592,00**	**4.442.220,00**	**8.884.440,00**	**23.105.595,64**
1.	Total incomes	0,00	7.984.813,37	1.184.592,00	4.442.220,00	8.884.440,00	14.807.400,00
2.	Financial resources	21.079.907,31					
	2.1. Internal resources	10.365.860,02					
	2.2. External resources	10.714.047,28					
3.	Salvage value	0,00	0,00	0,00	0,00	0,00	8.298.195,64
	3.1. Fixed assets	0,00					6.381.840,43
	3.2. PWC	0,00					1.916.355,21
II.	**Total cash outflow (4+5+6+7)**	**21.079.907,31**	**3.404.328,57**	**3.723.256,19**	**8.435.905,34**	**8.351.392,27**	**8.382.800,88**
4.	Value of investment	21.079.907,31					
	4.1. In fixed assets	19.163.552,10					
	4.2. In PWC	1.916.355,21					
5.	Costs without depreciation and interest on the loan	0,00	3.404.328,57	3.723.256,19	4.035.363,74	3.950.850,67	3.982.259,28
6.	Income tax	0,00	0,00	0,00	0,00	0,00	0,00
7.	Annuities	0,00	0,00	0,00	4.400.541,60	4.400.541,60	4.400.541,60
III.	**Net cash flow (I-II)**	**0,00**	**4.580.484,80**	**-2.538.664,19**	**-3.993.685,34**	**533.047,73**	**14.722.794,76**

Source: IAE, Belgrade, 2020.

Table 5. Economic flow (in RSD)

No.	Element	Initial moment	Year of the investment realization				
			1	**2**	**3**	**4**	**5**
I.	**Total cash inflow (1+2)**	**0,00**	**7.984.813,37**	**1.184.592,00**	**4.442.220,00**	**8.884.440,00**	**23.105.595,64**
1.	Total income	0,00	7.984.813,37	1.184.592,00	4.442.220,00	8.884.440,00	14.807.400,00
2.	Salvage value	0,00	0,00	0,00	0,00	0,00	8.298.195,64
	2.1. Fixed assets	0,00					6.381.840,43
	2.2. PWC	0,00					1.916.355,21
II.	**Total cash outflow (3+4)**	**21.079.907,31**	**3.404.328,57**	**3.723.256,19**	**4.035.363,74**	**3.950.850,67**	**3.982.259,28**
3.	Value of investment	21.079.907,31					
	3.1. In fixed assets	19.163.552,10					
	3.2. In PWC	1.916.355,21					
4.	Costs without depreciation and interest on the loan	0,00	3.404.328,57	3.723.256,19	4.035.363,74	3.950.850,67	3.982.259,28
5.	Income tax	0,00	0,00	0,00	0,00	0,00	0,00
III.	**Net cash flow (I-II)**	**- 21.079.907,31**	**4.580.484,80**	**- 2.538.664,19**	**406.856,26**	**4.933.589,33**	**19.123.336,36**

Source: IAE, 2020.

According to available data about investment in plum orchard establishment, it was made the evaluation of the investment profitability by the use of dynamic methods for the assessment of investment effectiveness (calculating of following indicators - Net present value (NPV), Internal rate of return (IRR) and Dynamic payback period (DPP) are given in Tables 6. and 7.). Additionally, for the evaluation of the economic effects of investment in the conditions of uncertainty the break-even point method was used to.

The NPV of the investment is 1,243,655.78 RSD, representing the overall increase in profit gained by the use of realized investment, after the discounting to current moment. Since the NPV is positive, the investment is considered as economically justified.

As the IRR (5.43%) is higher than the used discount rate (4.03%), according to this indicator investment could be also considered economically justified.

The dynamic payback period for the establishment of plum orchards is 4.92 years, i.e. the investment will be returned in 4 years and 11.05 months. As the DPP is shorter than the period of investment exploitation (in line to obtained bank credit on 5 years), the investment could be considered economically justified.

Table 6. Net present value (NPV) and Internal rate of return (IRR), (in RSD, in %)

No.	Element	Initial moment	Year of the investment realization					Cumulative
			I	II	III	IV	V	
0	1	2	3	4	5	6	7	8
1.	Net cash flow from economic flow (columns 3 to 7)	-21.079.907,31	4.580.484,80	-2.538.664,19	406.856,26	4.933.589,33	19.123.336,36	***26.505.602,55***
2.	Discount rate (in %)	4,03	4,03	4,03	4,03	4,03	4,03	-
3.	Discount factor $(1+i)^{-n}$, i = discount rate; n = year of the investment duration	1,0000	0,9612	0,9240	0,8881	0,8537	0,8206	-
4.	Present value of net cash flow from economic flow (columns 3 to 7)	-21.079.907,31	4.402.913,75	-2.345.647,35	361.349,28	4.211.898,75	15.693.048,67	***22.323.563,08***
5.	**NPV (columns 2 to 7)**	**1.243.655,78**						
6.	**Relative NPV [(columns 2 to 7) / | column 2|]*100 > i**	**0,06** (meaning – relative increase in accumulation above the price of capital, i.e. discount rate (i=4,03%), so by the investment implementation it will come to covering of the price of capital and gaining of certain amount of profit)						
7.	**IRR > i**	**5,43%**						

Source: IAE, 2020.

Table 7. Dynamic payback period (in RSD, DPP < n)

Year of investment realization	Present value of net cash flow from economic flow	Cumulative net cash flow
0	-21.079.907,31	-21.079.907,31
I	4.402.913,75	-16.676.993,56
II	-2.345.647,35	-19.022.640,91
III	361.349,28	-18.661.291,64
IV	4.211.898,75	-14.449.392,89
V	15.693.048,67	1.243.655,78

Source: IAE, 2020.

Table 8. Break-even point (in RSD)

No.	Description	Year of the investment realization				
		I	II	III	IV	V
1.	Incomes (P)	0,00	1.184.592,00	4.442.220,00	8.884.440,00	14.807.400,00
2.	Variable Costs (VT)	3.355.043,09	3.657.542,22	3.945.753,78	3.862.840,89	3.894.249,49
3.	Fixed costs (FT)	49.285,48	65.713,97	89.609,96	88.009,79	88.009,79
4.	Gross margin	-3.355.043,09	-2.472.950,22	496.466,22	5.021.599,11	10.913.150,51
5.	Break-even point (relative), in %	-1,47	-2,66	18,05	1,75	0,81
6.	Break-even point (value), in RSD	0,00	-31.478,29	801.801,12	155.710,89	119.415,20
7.	Margin of safety in %		102,66	81,95	98,25	99,19

Source: IAE, Belgrade, 2020.

Notice: Positions 4; 5; 6 and 7; were calculated according to the following formulas

- Gross margin (MR = P-VT)
- Break-even point (relative), (PTV = (P x PTR) /100),
- Break-even point (value), (PTV = (P x PTR) /100),
- Margin of safety (SS = ((1 - (PTV / P)) x 100)

According to gained break-even point, it could be seen that the investment is also acceptable in cases of significantly large decrease in production volume or incomes (Table 8.), while the observed investment shows a low level of risk.

Conclusion

Plum production is very common in Serbia. Given the long tradition in plum farming, it is necessary to eliminate the certain shortcomings in its production, as well as to widely introduce in current plum production adequate contemporary tech-tech solutions.

According to that, in paper was calculated the posible profit that could be gained in modern plum farming, as well as the economic analysis of the effectiveness of investment in establishment in appropriate plum orchard. It was determined that investing in plum plantation that will be used for the production of table plums is economically justified and associated with relatively low level of risk. In line to potential problems with plums realization at local market, the priority was found in ensuring the stability of market for table (fresh) plums in the long run.

Literature

1. Duralija, B. (2002): Vegetativne i generativne osobine stonih sorti šljiva. *Pomologia Croatica,* 8(1-4):51-64.
2. FAO (2020): *Data related to plum production*. Food and Agriculture Organization (FAO), Rome, Italy, FAOSTAT database, retrieved at: www.fao.org/faostat/en/#data, 15th October 2020.
3. IAE (2020): *In-depth interviews with fruit growers - reports*. Internal documentations of the Institute of Agricultural Economics (IAE), Belgrade, Serbia.
4. Ivanović, S. Marković, T. (2018): *Upravljanja investicijama u agrobiznisu*, Poljoprivredni fakultet, Beograd, Srbija.
5. Karić, M., Ćejvanović, F. (2004): Analiza troškovi-koristi za odlučivanje o poticanju investiranja u nasade šljiva, *Poljoprivreda*, 10(2):1-8.
6. Keserović, Z., Magazin, N., Kurjakov, A., Dorić, M., Gošić, J. (2014): *Voćarstvo - Popis poljoprivrede 2012.: Poljoprivreda u Republici Srbiji.* SORS, Belgrade, Serbia.
7. Lukač Bulatović, M., Vukoje, V., Milić, D. (2017): Ekonomski indikatori proizvodnje važnijih voćnih vrsta u Vojvodini. *Ekonomika poljoprivrede*, 64(3):973-985.

8. MAFWM (2019a): *Izveštaj o stanju u poljoprivredi u Republici Srbiji u 2019. godini (Zelena knjiga II).* Ministry of Agriculture, Forestry and Water-management (MAFWM), Belgrade, Serbia.
9. MAFWM (2019b): *Pravilnik o podsticajima programima za unapređenje konkurentnosti za investicije u fizičku imovinu poljoprivrednog gazdinstva kroz podršku podizanja višegodišnjih proizvodnih zasada voćaka, vinove loze i hmelja.* Official Gazette of the Republic of Serbia, no. 37/17, 44/18 – other laws, 3/19 and 36/19.
10. Prodanović, R. (2015): *Uticaj relevantnih faktora na proizvodnju, preradu i promet organskog voća*. Doktorska disertacija, Fakultet za ekonomiju i inženjerski menadžment, Novi Sad, Srbija.
11. SEEDEV (2020): *Sektorska analiza proizvodnje i prerade voća u Repubici Srbiji: Za potrebe IPARD 3 programiranja.* SEEDEV, Beograd, Srbija.
12. SORS (2012): *Census of Agriculture 2012.* Data base of the Statistical Office of the Republic of Serbia (SORS), Belgrade, Serbia, retrieved at: www.stat.gov.rs/, 10th November 2020.
13. SORS (2018): *Farm structure survey 2018*. Data base of the Statistical Office of the Republic of Serbia (SORS), Belgrade, Serbia, retrieved at: www.stat.gov.rs/, 10th November 2020.
14. Stevanović, S., Stevanović, S., Janković Šoja, S. (2018): Regionalna obeležja tržišne proizvodnje voća i grožđa u Srbiji. *Ekonomika poljoprivrede*, 65(1):201-214.
15. Subić, J. (2010): *Specifičnosti procesa investiranja u poljoprivredi*. IAE, Belgrade, Serbia.
16. Subić, J., Nastić, L., Potrebić, V. (2013): Economic effects of the thermal water use in vegetable production on the territory of Central Danube region. *Economics of Agriculture*, 60(4):745-757.
17. Trajčevski, T. (2008): Djelotvornost kemijske zaštite šljive od napada patogena Monilinia laxa. *Glasnik zaštite bilja.* 31(5):90-94.
18. Vukoje, V., Milić, D. (2009): Ekonomski efekti u proizvodnji važnijih vrsti voćaka. *Ekonomika poljoprivrede*, 56(3):3

AGRICULTURAL SECTOR RESULTS IN THE FUNCTION OF SUSTAINABLE DEVELOPMENT OF SERBIA'S ECONOMY

Jugoslav Aničić[1], *Vuk Miletić*[2], *Dušan Aničić*[3]

Abstract

The achieved business results of the companies from the agricultural sector, on one hand, along with the natural resources and favorable climatic factors, on the other hand, undeniably indicate great opportunities for intensive and efficient development of this sector and increase in its international competitiveness. In order to achieve that, limiting factors in the development of agriculture should be eliminated, among which the most important are unfavorable financing conditions and low level of public and private investments in the agricultural sector. Agricultural policy makers should insist on structural changes in the agricultural sector that will lead to an increase in the share of higher value-added products in total production and supply. In doing so, the principles of sustainable development must be applied, which will, in the long run, give economic effects and improve the quality of life of the population.

Key words: *agriculture, sustainable development, enterprise, Serbia.*

Introduction

The agricultural sector still takes a significant place in the overall development of the economy, regardless of the general trend at the global level, which is the reduction of the share of agriculture in the gross national product and employment. The contribution of agriculture is measured through economic-social, scientific-technological and environmental aspects. This sector has significantly contributed to the development of industry in highly developed countries, and in developing countries it still plays a significant role in overall economic development. The future successful development of agriculture will largely depend on the application of modern technology that is adapted

1 Jugoslav Aničić, Ph.D., Full Professor, University „Union - Nikola Tesla", Faculty of Economics and Finance, Cara Dušana no. 62-64, 11000 Belgrade, Serbia, Phone: +381 64 24 77 199, E-mail: ajugoslav@yahoo.com

2 Vuk Miletić, Ph.D., Assistant Professor, High School of Academic Studies „Dositej", Nušićeva no. 12a, 11000 Belgrade, Serbia, Phone: +381 60 05 20 154, E-mail: vuk.miletic88@gmail.com

3 Dušan Aničić, Ph.D., Assistant Professor, University „Union - Nikola Tesla", Faculty of Economics and Finance, Cara Dušana no. 62-64, 11000 Belgrade, Serbia, Phone: +381 64 40 82 692, E-mail: anicic.dusan@yahoo.com

to the environmental requirements of countries. Although adapting to the requirements of sustainable development may currently slow down economic growth, this orientation will, in the long run, bring appropriate results in terms of economic growth and quality of life of the population.

The agricultural sector in Serbia operates under difficult conditions, both in the global environment and in the dependence of agricultural production on climatic and seasonal influences and other specifics of this sector. One of the key reasons for the insufficient competitiveness of this sector is the lack of large investments, both in infrastructure and other public and private investments. In such conditions, the business results of this sector, measured by data from their financial statements, show that there is room for a great improvement in the efficiency of the sector. Turnover ratios, ratio indicators, liquidity and other indicators point out the need to improve the financial structure of the sector as well as the relations between fixed and current assets, capital and liabilities, etc. The openness of the country and low interest rates on the money and capital markets are just some of the favorable circumstances for faster and more comprehensive development of production, processing and trade of agricultural products.

The contribution of agriculture to the sustainable development of Serbian economy

Agriculture is closely connected with other economic activities as well as the needs of society as a whole. Therefore, great attention is paid to the issues of adequacy of its structure and increase of competitiveness with the aim of improving this activity and achieving the best possible economic, social and other effects in the development process. Conversance of the factors that have the greatest impact on the formation of the structure of agriculture and its efficiency will contribute to the formulation of a successful agricultural policy with the aim of its sustainable development in the long run.

The general trend at the global level is a decrease in agriculture's share in the national product and total employment. Also, structural changes in agriculture are less intense compared to the secondary and tertiary sectors of the economy. Investments, which are the basis of the overall development, have a decisive influence on the competitiveness of agriculture. One of the reasons for Serbia's lagging behind in economic development compared to EU countries is much lower share of investments in gross domestic product, especially public and private. Regardless of the relatively high foreign direct investment, dynamic and sustainable economic development cannot be achieved without a significant share of domestic investment.

The contribution of agriculture to the overall development can be monitored through three groups of indicators: economic-social, scientific-technological and environmental. As far as Serbia is concerned, agriculture has traditionally played a large and significant role in it as a raw material basis for the processing industry, with a pronounced economic and social function. Agriculture has a large share in the social product of Serbia, employs a large number of workers and has a positive effect on the country's balance of payments because it has higher exports than imports. The development of agriculture is based on the Strategy of Agricultural Development for the period 2014-2024, adopted by the Government of the Republic of Serbia (Strategy, 2014).

Rapid economic development is achieved, among other things, by timely structural changes that most often mean shifting the economic structure from primary production (agriculture, mining) to industry and tertiary activities (Krstić, et al. 2015). At the same time, these trends are influenced by a number of factors, both individually and in correlation, whose relative effect changes with the passage of time, new technological achievements and innovations in the economy. Structural changes in agriculture are most often associated with periodic changes in general economic or political conditions and influences.

Historically, the agricultural sector has significantly contributed to the development of the process of industrialization and the overall economy of developed countries. In developing countries, its role is still of great importance, and it should be noted that the development of these two sectors should be complementary and not as cross-sectoral competition. Certain characteristics indicate the specificity of agriculture in relation to other sectors (Gardner, Rauser, 2002), starting from the impact of climate and seasonal changes, reliance on land as a non-reproductive factor of production, dispersion of producers from individual farms to large agricultural conglomerates and others.

In the international market order related to agriculture, globalization has resulted in declining farmers' incomes, increasing reliance on subsidies, and huge profits for market-controlling intermediaries, thus preventing any form of competition that would benefit producers (Sol, Ralston, 2011). A high percentage of food production and other commodity industries are now controlled by multinational companies. Many authors believe that industrialized agriculture today is the most destructive form of modern dumping because it undermines the ability of farmers in both production and consumer societies to earn enough income to stay in their jobs (Aničić, et al. 2018).

With the economic growth of a country, the relative importance of agriculture decreases because the share of agriculture in relation to the share of the industry and services sector decreases. On the other hand, due to the satisfaction of the existential needs of the inhabitants, its role is irreplaceable and becomes more and more important, having in mind the population growth, climate change, limited natural resources, etc. Also, in developed countries, the share of the population engaged in agriculture is declining due to the intensification of this activity and the growth of productivity in it.

The basis for the development of sustainable agriculture is the use of modern technology that is adapted to the ecological conditions of the country. Innovations in agriculture should lead to the preservation of natural resources, provide a balanced level of supply and demand for agricultural products, as well as motivate the agricultural population, the scientific sector and other participants in the chain of agricultural production and trade. Thus, productivity growth and overall agricultural development cannot be separated from the development of other sectors (Xinshen et al., 2007).

Agriculture has an indisputably important role in developing countries, where Serbia also belongs, and this role can be observed through three levels (Lee, 1992): traditional (static), transitional and modern (dynamic). The contribution of the agricultural sector to the development of the rest of the economy increases by moving from one level to another. For example, the goals in the static phase are of an existential nature, while in the dynamic phase it is the total income and the realization of profit; in static form the technology is traditional and in dynamic form it is based on innovations; in the static form there is a large share of agrarians in the domestic product, and in the dynamic phase it is small, etc.

The principles and goals of sustainable development are universal principles, binding on all countries regardless of the level of development, geographical affiliation and other differences between them. Long-term, comprehensive and balanced needs of present and future generations, as well as their interests, must be in the forefront. The concept of sustainable development is based on economic, social and environmental aspects.

Adapting to the principles of sustainable development can currently slow down economic growth, but in the long run it will have positive effects because it will result in both economic growth and a better quality of life for the population. Preservation of natural resources is increasingly emphasized as a primary goal in relation to production, economic, regional and other goals (Pokrajac, 2009). Sustainable use of natural resources will lead to an increase in aggregate productivity greater than losses due to the use of resources or their replacement by other resources due to depletion (Goodstein, 2003).

Achieved results of the agricultural sector

The global economic crisis has inevitably affected the entire Serbian economy. In such an economic environment, according to Table 1, a trend of positive macroeconomic trends in Serbia has been achieved, despite the slowdown in the global economy. Economic activity is growing, and the main drivers of that growth are the inflow of foreign direct investments, the growth of exports and public and private consumption. The low inflation rate and stable exchange rate were maintained, and the number of employees and the level of salaries increased.

Table 1. Basic macroeconomic indicators.

Description	Year	
	2019	2018
GDP (in millions of dinars, current prices)	5.410.794,3	5.068.588,5
GDP's growth rate	4,2	4,4
Export (in millions of euros)	17.533,4	16.282,0
Import (in millions of euros)	23.875,1	21.918,7
Number of employees (in thousands)	2.101	2.053

Source: Serbian Business Registers Agency (2020)

Companies from the agricultural sector in Serbia are burdened with numerous problems that afflict the entire economy, as well as problems specific to this sector. Large number of these companies operate with small equity or insufficient financial resources, which produces dependence on state subsidies and other givings. Infrastructure is underdeveloped and public investments in infrastructure are low, so entire regional areas suffer enormous damage due to such a situation. All this is reflected in the business of companies from this sector, which in recent years, according to the results from financial statements, lags behind in development in other sectors, especially services.

In the continuation of the work, some of the business indicators of the agricultural sector are singled out, based on the data of the Business Registers Agency from the submitted financial statements for 2019 and previous years.

The business results of the agricultural sector in 2019 in many segments were weaker than in the previous year, according to Table 2. Thus, we see that the total revenues of the sector fell compared to the previous year by 3,6%, but the business result is higher by 9,5% because the total expenditures of the sector also decreased. The ratio of total revenues to total assets and fixed assets indicates a very low turnover ratio of total and fixed assets. Similar to the above, other indicators of turnover, profitability and business efficiency are low, which in turn indicates unfavorable trends in business.

Table 2. Revenues and expenses' structure of the A sector Agriculture, forestry and fishing (in millions of dinars)

Description	Amount	Index
Total revenues	370.064	96,4
Total expenses	361.962	96,4
Business result	10.107	109,5
Financing result	-1.329	109,2
Net result	6.185	%

Source: Serbian Business Registers Agency (2020).

According to the data in Table 3, it can be seen that the agricultural sector in 2019 had a total assets of 874.452 million dinars, of which fixed assets (intangible assets, real estate, plant and equipment, long-term financial investments) account for over 70%, and current assets participate with less than 30%. At the same time, the current assets of the sector are approximately equal to short-term liabilities (258.151: 256.380), which indicates that the general liquidity ratio is very low given the desirable theoretical norm of 2: 1. Such a position forces companies to defend liquidity with loans and credits under unfavorable conditions, hence we have a negative result from financing at the sector level.

Table 3. Operating assets' structure of sector A Agriculture, forestry and fishing (in millions of dinars)

Description	Amount	Index
Subcribed, but unpaid capital	379	108,9
Fixed assets	614.517	103,5
Deferred tax assets	1.404	95,4
Current assets	258.151	102,8
Total operating assets	874.452	103,3

Source: Serbian Business Registers Agency (2020).

In the structure of financing sources according to Table 4, we see that the share of capital in total liabilities is 62,25%, which is a high share of own sources of financing, and at the same time indicates the already mentioned difficulties in providing loans according to the needs of this sector. Loans required for the development of this sector must be adjusted to its needs, both in terms of interest rates and maturities, as well as the grace period due to seasonal and climatic influences on this production. The structure of liabilities is unfavorable, because short-term liabilities are more than twice higher than the long-term ones. The total capital of the sector is less than the amount of fixed assets, which means that one part of fixed assets is financed from borrowed sources; however, as the turnover ratios of total and fixed assets are low, this indicates difficulties in recovering foreign sources of financing and a low level of liquidity in the sector.

Table 4. Financing sources' structure of sector A Agriculture, forestry and fishing (in millions of dinars)

Description	Amount	Index
Capital	544.362	104,0
Long-term provisions and liabilities	122.425	108,1
Deferred tax liabilities	7.886	91,3
Short-term liabilities	256.380	98,3
Loss which exceeds capital value	46.601	94,8
Total liabilities	874.452	103,3

Source: Serbian Business Registers Agency (2020).

Conclusion

Agricultural production has an important place in the economic progress of developing countries, including Serbia. This sector has a positive foreign trade balance, which can be further improved, and significantly contributes to the country's balance of payments in foreign relations. Agriculture contributes to a more balanced regional development, reduces unfavorable migrations to urban areas and abroad, reduces unemployment, etc. Since Serbia has favorable climatic conditions and natural resources, it remains to improve the financing conditions of this sector through economic policy. In this way, innovation and new technology will be applied in the sector, which will increase its competitiveness and improve its contribution to GDP growth and the overall economic development of the country.

Literature

1. Agencija za privredne registre, (2020): *Saopštenje o poslovanju privrede u Republici Srbiji u 2019. godini,* Beograd
2. Aničić, D., Obradović, M., Vukotić, S. (2018): Impact of Economic Policy on the Management of Competitiveness of the Agriculture Sector in Serbia, *Economics of Agriculture*, Vol. LXV, No 1, p. 187-200.
3. Gardner, B.L. & Rausser, G.C. (2002): *Handbook of Agricultural Economics* (T.2). Amsterdam: Elsevier.
4. Goodstein, E., (2003): *Ekonomika i okoliš* (drugo izdanje), Zagreb, MATE
5. Xinshen, D., Hazell, P., Resnick, D. & Thurlow, J. (2007): *The Role of Agriculture in Development: Implications for Sub-Saharan Africa.* Washington: International Food Policy Research Institute.
6. Lee, M. (1992): *A Survey of Agricultural Economics Literature: Agriculture in Economic Development 1940s to 1990s.* Minneapolis: University of Minnesota Press.
7. Krstić, B. & Stanojević, J. (2013): Human Capital Development as a Determinant of the Agricultural Competitiveness in Serbia. У *Improving the Competitiveness of Enterprises and National Economies – Factors and Strategies* (pp. 1-18). Niš: University of Niš, Faculty of Economics.
8. Pokrajac, S., (2009): *Održivi razvoj i ekološka ekonomija kao poslovne paradigme*, Škola biznisa, 4, str. 21-30.
9. Republika Srbija, *Strategija poljoprivrede i ruralnog razvoja Republike Srbije za period 2014-2024. godine* (Sl. glasnik RS“, br. 85/2014).
10. Sol, R., Dž., (2011): *Propast globalizma i preoblikovanje sveta*, Arhipelag, Beograd.

POSITION OF HOLDERS OF RIGHT TO RETURN LAND IN THE PROCEDURE OF RESTITUTION AND LESSEE OF LAND[1]

Ljiljana Rajnović[2], Zoran Brljak[3], Snežana Cico[4]

Abstract

In this paper, the authors analyze the status of the holder of the right to restitution of the confiscated land in relation to the holder of the right to lease the land subject to restitution and thus the rank of application of regulations on agricultural land in the restitution procedure in the Republic of Serbia. The return of property confiscated during the communist period is part of the transition process, which implies comprehensive changes in the state, including privatization of state-owned property and market operations on the principles of private property and competition, but also a need to correct injustice to former owners. According to the regulations of the Republic of Serbia, restitution is mandatory, but in practice it is realized very slowly, especially when the subject of restitution is the return of agricultural land, although this process realizes one of the basic human rights of citizens, defined in the international agreement, the UN Universal Declaration of Human Rights, the right to free enjoyment of private property. In this paper, the authors analyze the conditions for the return of agricultural land e.g., the conflict of interest of the owner of the returned property and the holder of the right to lease on the returned property, and the implemented solutions in practice, on the example of a local government unit.

Key words: *restitution, holder of the right to return, legitimate expectation, land lease, principles of the constitution, discrimination.*

Introduction

To assess the state of ownership of agricultural land in the Republic of Serbia, the authors used the official results of the 2012[5] agricultural census as

1 This paper is the result of research funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

2 Ljiljana Rajnović, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 63 273 237, E-mail: rajnovclj@gmail.com

3 Zoran Brljak, M.Sc., Educons University, Vojvode Putnika no. 85-87, 21000 Novi Sad, Serbia, Phone: +381 63 320 001, E-mail: zoran.brljak@educons.edu.rs

4 Snežana Cico, Ph.D., Severtrans a.d., Filipa Kljajića bb, 25000 Sombor, Serbia, Phone: +381 64 440 20 57, E-mail: snezanacico@gmail.com

5 Agriculture in the Republic of Serbia I 2013; Agriculture in the Republic of Serbia II 2013

well as other data from official statistics, the Agency for Restitution and the Agricultural Land Administration. Serbia is an agrarian country. The basic economic entities that perform agricultural activity are agricultural farms. There are 631,552 business entities in Serbia that own a total of 3,861,477 ha of agricultural land. Of this number, 628,555 are family farms, and 2,567 are enterprises, cooperatives, entrepreneurs and farms in private and state ownership or owned by churches and religious communities.

The total area of Serbia is 8,840,000 ha, of which agricultural land is 5,700,000 ha, and arable land 4,200,000 ha. The largest part of the territory of our country, 73% is agricultural land. Private arable land is 87%, average farm size: 3 ha, number of villages: 4,700, 55% of the population lives in rural areas and 45% of the active rural population works in agriculture.

This is the reason why regulations and activities related to agricultural land, return of agricultural land to previous owners, sale of land to domestic and foreign legal and natural persons, lease of state agricultural land, are always the subject of interest not only of economic entities to which they apply but also public in Serbia, which is not surprising, because most of the total territory of Serbia is agricultural land. As a country whose natural and climatic conditions favor the cultivation of various agricultural crops and as a country inhabited by almost 1.5 million farmers, these regulations will undoubtedly attract the attention of the Serbian public.

In this regard, the issue of restitution of agricultural land confiscated according to regulations from the post-communist period is also regulated. Restitution implies the return of ownership of property that in the past was unjustifiably taken away from certain persons, a group of citizens or an entire class or ethnic group in countries where certain, significantly different social circumstances previously existed.

The return of confiscated property is an issue that is simultaneously included in the process of transition of any post-communist country and, one of the unavoidable issues related to the European integration of a country that is interested in becoming a member of the European Union. Protocol no. 1. in addition to the European Convention for the Protection of Human Rights and Fundamental Rights[6], it does not create for the signatory states any general obligations or restrictions regarding the restitution of property (right to restitution, scope of return and conditions) This issue is left to states to resolve on the basis of their

6 European Convention for he Protection of Human Rights and Fundamental Freedoms.

regulations, but within the framework of the principles of conscientiousness and honesty and other principles of international law and the constitution of countries that have the obligation to return confiscated property[7].

Denationalization is a significant process of modern development, based on private ownership, decentralization, deregulation and weakening of the regulatory and managerial role of the state. Denationalization is related to the processes of economic growth and progress, based on technological development, globalization and market competition, with the aim of restoring liberal values in social life, and especially to the creation of open market economies. It is commonly believed that the advantages of private ownership are in greater initiative and motivation of private owners for more efficient management and operations as well as in greater mobility of goods, capital, labor and knowledge. Private ownership also extends to areas of service of general interest, which have traditionally been in the sphere of state ownership and management. The policy of returning the property to the previous owners is in line with that.

In this paper, the authors discuss the right of restitution holders to return agricultural land (primarily in nature) that was taken away on the basis of earlier regulations from the communist period, or even without grounds, without fair compensation or in some other similar way in relation to tenant rights returned land.[8] In the legal sense, restitution means the establishment of the previous situation in relation to the person from whom the property was confiscated, in the way it was before the act of confiscation and refers, primarily to the return of the same property that was confiscated, i.e. in nature.[9] In the practice of Serbia, a multi-year lease of land often appears as a restriction on the possession of the title of restitution on the returned land.

Restitution in Serbia and the right to lease

The reasons for the return of confiscated property in Serbia are based on the idea of including Serbia in the currents in Europe, harmonizing the legal and

---

7 Judgment of the European Court of Human Rights

8 Kozminski, K. A. 1997, Restitution of Private Property: Re-privatization in Central and Eaastern Europe, Communist and Post – Communist studies, The Regents of University of California, Press, Published by Elsevier Science Ltd, Great Britain, p. 95-106, (available at: https://online.ucpress.edu/cpcs/article/30/1/95/399/Restitution-of-Private-Property-Re-privatization)

9 Jugovic A., (2009) Restitution as a value turning point in the democratization of Serbian society, Rehabilitation and restitution in Serbia - Proceedings of the round table Belgrade, *Center for the Advancement of Legal Studies,* Congress of Serbian Unification, Studenica Endowment, p. 289-297.

institutional framework with EU member states, correcting the injustice done decades ago to former agricultural land owners and creating a new / old middle class economic entities.

Restitution is a big state project. In addition to the enactment of regulations, the real will of the government is necessary, which not only returns the property to its former owners, but also definitely introduces a new philosophy of private property whose protection should not only be declarative, but also real.[10]

The extent of the return of confiscated property to previous owners is based on the economic strength of the state, and the success on the reputation of the state, socially responsible behavior of the state, including respect for human rights.

Some countries have already carried out the restitution procedure with more or less success, in a shorter or longer period, which depends not only on the adopted regulations but also on the real political and social will, which is reflected in the consistent implementation of constitutional principles and principles of the constitution and laws. Serbia has not yet completed the procedure for returning the confiscated land, although the current law came into force in 2012. The biggest problems are in the procedures whose subject is the return of agricultural land. It has been shown that legal solutions cannot lead to results in practice if not everyone is equal before the law and the constitution. This brings us back to the rule of law, which is a precondition for exercising the individual rights of the owner of the confiscated property.

The most European countries initiated the restitution procedure in the 1990s. In Serbia, unlike most countries where the restitution procedure was conducted in a much shorter period, this procedure takes an unreasonably long time. Many claims for repossession of property, submitted to the competent institution at the time the law enters into force, have not yet been completed, usually without good reason. In addition, a major problem for restitution holders is the lease of land that is in the process of restitution. The land intended for return to the previous owners was leased, not only before the law on restitution came into force, but it was leased again all the time, for a period of one to five or more years.

This is an additional reason for dissatisfaction of restitution holders because they believe that not everyone is in the same position, some get property of much higher value and others much less, additionally burdened by multi-year lease, although most local governments have enough land to return. Although restitution removes moral injustice, it cannot be ideal, but it is very important

10 http://projuris.org/denacionalizacija.html.

to be fair and effective. It is also fair that the issue of restitution does not drag on for years, as it does in Serbia, and that the country that is the subject of restitution is not under a multi-year lease, but returns in the same agricultural year in which the return decision becomes final.

Otherwise, the Law on Agricultural Land[11], The law regulates the conditions and procedure for leasing state land, whereby the right to lease and use state-owned agricultural land can be exercised by natural and legal persons who are holders or members of registered agricultural holdings if they meet additional conditions depending on the lease basis. State-owned agricultural land is leased and used in a transparent procedure, based on the right of first refusal and through public bidding[12].

Information on which state-owned land is planned for leasing and use on what basis and for what period is available on the website of the Agricultural Land Administration. Decisions on announcing advertisements for the issuance of land are available, as well as a tabular overview of cadastral parcels for which a public invitation for issuance has been published and intended for issuance.

The Agricultural Land Administration has also developed its own public Geoportal, which provides numerous opportunities for quick and easy access to all data on state-owned agricultural land, maps and applications for the preparation of the Annual Program for the Protection, Development and Use of State-Owned Agricultural Land.

Thus, information on the status of state-owned agricultural land, including that which is subject to restitution, is public. In practice, there are many cases where the holder of restitution, when after many years receives a final decision on the return of land, cannot take possession because the land is under a multi-year lease. The price of leasing state land is significantly lower than the price of land of the same quality in the same area owned by a private person, who has a greater interest in earning, leasing or cultivating land in relation to the state as the owner. Thus, the benefit of the private owner from issuing the land (not counting the processing that gives higher income) is much greater than the benefit of the state.

11 Zakon o poljoprivrednom zemljištu („Službeni glasnik RS„ 62/2006, 65/2008 – dr. Zakon, 41/2009, 112/2015, 80/2017 i 95/2017 – dr. Zakon).

12 Uprava za poljoprivredno zemljište, https://upz.minpolj.gov.rs/sadrzaj/vest/kako-uzeti-pod-zakup-ili-na-koriscenje-poljoprivredno-zemljiste-u-drzavnoj-svojini/

Restitution of agricultural land in Serbia with the example of one local self-government unit

The Law on Restitution of Confiscated Property and Compensation stipulates that agricultural land, which was confiscated from the previous owners, will be returned to the applicants for the return of confiscated property.

The bylaw establishes the obligation of the Agency for Restoration (hereinafter: the Agency) to, on the basis of its data on claims from the submitted requests of previous owners for the return of property, inform the Agricultural Land Administration (hereinafter: the Administration) about the areas of agricultural land, are sought in certain cadastral municipalities. Based on that, the Administration is obliged to determine state-owned cadastral parcels in an area that will be sufficient to complete the procedure of property restitution, which may be subject to restitution in terms of the Law and Regulation on criteria for determining the area of agricultural and forest land in procedure for the return of confiscated property (Regulation).

The stated data, the List of determined cadastral parcels in state ownership that can be the subject of return in the restitution procedure (hereinafter: the List) must be accurate, publicly published on the website of the Administration and the Agency for Restitution. The Agency has the obligation to update them daily, so that all interested persons have the opportunity to be informed about the parcels that are intended to be returned in the restitution procedure, which parcels have already been returned during the procedure and which is left to be returned.

It is prescribed that the List may not include cadastral parcels that are at the time of entry into force of the decree:

- leased on the basis of consent to the investment plan given by the competent commission in accordance with the regulations governing the priority right to lease agricultural land;
- leased on the basis of ownership of infrastructure facilities;
- leased for more than ten years[13].

It is known that the most problems in the restitution procedure were and still are, precisely in cases when the subject of return is agricultural land. In all local self-government units (LGUs) in the whole of Serbia, there is much more state

13 Zakon o vraćanju oduzete imovine i obeštećenju ("Sl. glasnik RS", br. 72/2011, 108/2013, 142/2014, 88/2015 - odluka US i 95/2018).

land in relation to the area of land claimed in the restitution procedure.[14] The Administration has compiled a list of cadastral parcels intended for return in the restitution procedure. However, large areas of agricultural land are exempt from return and given on long-term lease. One number of restitution holders was given back quality land in one piece, and a large number of the remaining ones were offered land that is under long-term lease or low-quality land, small plots of land below or about one hectare, which are far from each other, which no one wants which led to a delay in the process of returning agricultural land[15] and the initiation of numerous judicial and administrative proceedings.

Due to the insufficient allocation of the fund for the return of the land, the holders of restitution were brought into an unequal position. Those who are offered low-quality land and under lease, believe that they have been damaged, that the right to fair restitution and the principle of equality have been violated, and have decided to conduct court proceedings. The state cannot put the previous owners in an unequal position, and at the same time, since it could predict the moment of land return, it could adjust the plans for leasing the land to restitution because there is a sufficient state land fund that can be restituted.

In order to determine the possibility of returning agricultural land in the restitution procedure, the authors analyzed the condition of the existing state fund of state land in relation to the amount requested in the restitution procedure in JLS Ruma in Vojvodina. In 2016, according to public data published on the website of the Administration, there were a total of 7,207,4594 hectares of arable agricultural land in the observed local self-government.[16].

Based on public data from the Agency, the previous owners are claiming 1,248,1484 hectares, which represents only 17.32% of the total available state fund. In all neighboring LGUs, the percentage of claims of restitution holders was approximate, so that in LGU Ruma, there is enough quality state land to return in the restitution procedure and the issuance of land can be done annually.

This obviously discriminated against a large number of persons claiming property in the restitution procedure. At the heart of such confrontations between the state and the title holders of restitution lies the lack of will of the state to return quality agricultural land without encumbrance, when there is enough for all title holders to return confiscated property.

14 Gulan B. (2015) Sudbina oduzete imovine, Novi Sad

15 http://www.agronews.rs/drzava-iz-restitucije-izuzela-najbolje-zemljiste/

16 https://upz.minpolj.gov.rs/sadrzaj/

The relationship between the legitimate expectations of the holder of restitution and the right of lease

The authors of this text believe that it is possible to avoid the problem of returning the leased land, ie to solve the problem of conflict of interest, the person to whom the land was returned in the restitution procedure and the state, ie the lessee of the returned land. For example, the land was returned to the holders of restitution according to the decision on the return of the confiscated land, which is dated 17.04.2020. years. However, that land was leased for five years, according to a previously conducted public invitation, after which a lease agreement was concluded on April 19, 2020. years, ie only two days after the decision of the restitution agency on the return of land.

In this and similar cases, the question arises whether the said conflict of interest could have been avoided and who is responsible for damages to the party suffering the damage, whose right is stronger, whether the right of the new landowner or the tenant, whether there is discrimination and violation of basic moral principles guaranteed by the Constitution?

As described above, the procedure of leasing land lasts for months, the restitution procedure lasts for years, but the legitimate expectation of the title of restitution by the competent authorities is easy to determine so that the state as a participant in both procedures has knowledge of which country is subject to restitution. he knows at what point the land subject to restitution will be returned to the previous owner. By the act of determining the holder of restitution for the return of certain pre-offered parcels, the numbers of parcels that will be returned and to which person they will be returned, are publicly announced on the List, so that everyone can know which land should be returned to the new owner within a reasonable time, who should take possession at the end of the current agricultural year, on October, 03th.

Thus, the holder of the right to return the property can claim the confiscated property in the legally prescribed procedure, only when the prescribed conditions under which this "legitimate expectation" can be realized. The assets do not exist until a claim can be established over it, which occurs when the prescribed conditions occur.[17]

The European Convention for the Protection of Human Rights and Fundamental Freedoms (the Convention) guarantees the owner the right to unhindered enjoyment of property, i.e, the prohibition of restriction of property

17 Odluka Ustavnog suda Srbije br. I-Uz.119/2008 od 20.04.2011.

rights and other property rights on any grounds, without compensation, which includes the prohibition of confiscation. However, since the Convention cannot be applied retroactively, it therefore does not establish the obligation of the state to eliminate violations of property rights that occurred before its entry into force. The Convention defines the definition of property, according to which property includes a claim based on which there is a legitimate expectation that the effective enjoyment of a property right can be acquired.[18] This legitimate expectation is in fact the fulfillment of the conditions for acquiring the rights from the restitution procedure, but also the moment when the state is aware that certain parcels will be returned to the holder of the rights from restitution within a reasonable time. At that moment, the state becomes unscrupulous if it leases the land for several years and thus prevents the new owner from freely disposing of the property.

In order to exercise a right under the provisions of the Convention, there must be "at least a legitimate expectation" that a particular property right can be exercised, and a legitimate expectation exists only when the Contracting State prescribes the conditions under which that expectation will be exercised, in terms of prescribing the conditions under which he will return the property.[19] The Republic of Serbia has prescribed by law the conditions under which it will return property to the right holders in the restitution procedure. This means, for example, if a request for restitution of property has been submitted, and it is necessary, as a prescribed condition, to rehabilitate the previous owner, the condition for restitution of property or compensation was acquired only when the decision on rehabilitation becomes final.

From the above, it can be concluded that state bodies that participate in the process of returning confiscated property, have accurate information when, first of all, a request for return of confiscated property is submitted, and then, when a legitimate expectation has arisen and based on that they can make plans , fairly and without discrimination, so that every acquirer of land could take possession of his returned property at the end of the first agricultural year. Conscientiousness is a social norm through which the highest values of society are concretized and must be respected.

18 Evropska konvencija za zaštitu ljudskih prava i osnovnih sloboda.

19 Evropska konvencija za zaštitu ljudskih prava i osnovnih sloboda.

Conclusion

According to the regulations from the communist period, the return of confiscated property also depends on external influences that occur in the environment. Currently, the process of returning the confiscated property is the most significant continuation of the changes in the ownership structure in agriculture of the post-communist countries of Eastern and Central Europe, which has an unavoidable impact on Serbia as well. In addition, globalization, which has affected the world economy for decades, inevitably creates a new economic order based on the dominance of the market economy within each country and internationally, private property ownership, market liberalization, strong competition from other economic entities and other changes.

Restitution is a procedure that must be carried out in Serbia in a fair way, so that all holders of the right to return confiscated property are in the same position because the state must be moral. The law must be socially purposeful, just, but also morally justified, which is not always the case, especially when it comes to discriminatory laws that can arise in different systems and times.[20] Thus, for example, it can be said that confiscation of property without compensation, through agrarian reform and nationalization and other regulations, is an unjust act, contrary to legal morality, although it is based on a legal act in the post-communist period in Serbia and other European countries.

Legal morality is contained in law and legal norms, as well as in the behavior of all those who apply or do not apply those norms. The state must be moral.

Literature

1. Agriculture in the Republic of Serbia I 2013: Agriculture in the Republic of Serbia II 2013.
2. European Convention for he Protection of Human Rights and Fundamental Freedoms, 1950, Rome.
3. Judgement of the European Court for Human Rights.
4. Konzminski, K., A. (1997): Restitution of Private Property: Re-privatization in Central and Eaastern Europe, Re-privatization in Central and Eaastern Europe, Communist and Post – Communist studies, The Regents of University of California, Press, Published by Elsevier Science Ltd, Great Britain, p. 95-106, (available at: https://online.ucpress.edu/cpcs/article/30/1/95/399/Restitution-of-Private-Property-Re-privatization).

20 https://projuris.org/pravni_moral.html

5. Jugović, A., (2009): Restitution as a value turning point in the democratization of Serbian society, Rehabilitation and restitution in Serbia - Proceedings of the round table Belgrade, *Center for the Advancement of Legal Studies,* Congress of Serbian Unification, Studenica Endowment, p. 289-297.http://ipf.rs/restitucija-u-srbiji-i-postkomunistickim-zemljama/.
6. The Law of Agriculture land („Official Gazette of RS„ 62/2006, 65/2008 – other Law, 41/2009, 112/2015, 80/2017 i 95/2017 – other Law).
7. Administartion of Agriculture Land.
8. Law of restitution and of Taken Away property and Compensation ("Official Gazette of RS", No. 72/2011, 108/2013, 142/2014, 88/2015 – Decision of the Constitutional Court and 95/2018).
9. Decision of the Constitutional Court of Serbia No: I-Uz.119/2008 ; (date 20.04.2011.)

Internet source:

10. https://projuris.org/denacionalizacija/html
11. https://www.agronews.rs//drzava-iz-restitucije--izuzela-najbolje-zemljiste/
12. https://upz.minpolj.gov.rs/sadrzaj/
13. https://projuris.org/pravni_moral.html

MICROECONOMIC ANALYSIS OF MANAGEMENT IN HUNTING GROUNDS IN SERBIA[1]

Marija Popović[2], Zoran Popović[3]

Abstract

A research work into the profit of hunting ground game users was conducted in four hunting grounds within three hunting regions managed by hunter associations in Serbia. Both a total registered breeding stock, and big and small game bag record (roe deer, wild boar, hare, pheasant, quail, mallard, wolf and fox) in 2017/18 were analyzed. On the basis of the analysis, it was concluded that there is a difference in total profit and in the profit per 100 hectares of total area of hunting ground between different hunting ground users in Serbia. The highest total profit of game bag record is realized by Dubrava hunting ground amounting to EUR 19,636. The highest profit per 100 hectares of total area is also realized by Dubrava hunting ground amounting to EUR 55, followed by Jadar hunting ground amounting to EUR 39, Takovo hunting ground amounting to EUR 26 and Klisura hunting ground amounting to EUR 13. The profit per surface unit varies considerably among different hunting grounds and among the hunting grounds of the same region depending considerably on the intensity of management of wild game populations in hunting grounds.

Key words: *game, hunting grounds, income, game bag record.*

Introduction

Microeconomic analysis of management of hunting game species in a hunting ground impliesfocusing on those populations which are exploited in hunting ground and which are from an economic aspect significant for hunting ground users. The goal of every economic entity and of hunting ground users likewise is to achieve maximum profit with the lowest possible expenditures. Total area of hunting grounds in Serbia is 8,828,438.29 hectaresthe average size of hunting ground managed by a Hunter`s Association of Serbia being 34,763 hectares (Popović et al., 2008.).

---

1 This research paper is part of project research work per Contract no. 451-03-68/2020-14/20016 of 24.01.2020 financed by the MNTR of the Republic of Serbia.

2 Marija Popović, Ph.D. candidate, Faculty of Agriculture, University of Belgrade, Nemanjina no. 6, 11080 Zemun, Serbia, Phone: +381 64 4099 865, E-mail: marija.popovic11@gmail.com

3 Zoran Popović, Ph.D., Full Professor, Faculty of Agriculture, University of Belgrade, Nemanjina no. 6, 11080 Zemun, Serbia, Phone: +381 11 83 32 769, E-mail: zpopovic@agrif.bg.ac.rs

The most significant game species managed in hunting grounds of the Hunter`s Association of Serbia are: hare, pheasant, field partridge, roe deer and wild boar. It is quite certain that their spatial distribution and presence in some hunting grounds are primarily influenced by natural factors but the impact of anthropogenic factor is also quite pronounced, especially for some species (Popović et al., 2012).

A development of hunting in Serbia is influenced also by the transformation of social system in accordance with the political processes of joining the European Union as well as international conventions (*Adamič et. al. 2006*).

By enacting the Law on Game and Hunting (2010) the hunting ground users to whom the state has given to manage the game as a property of common concern are forced to transit to a market-oriented operation system. The incomes are in the first place influenced by a price list (for tourists, for members of hunter`s associations, price list regulated by a minister for paying compensation at the account of game exploitation) according to which the game is being sold, as well as by an animal sex and trophy structure of big game species harvested.

An economic performance is being derived from all the determinants of hunting value (game bag record, trophy and body mass). Considering that economic results of raising the game depend on characteristics of hunting ground (size, species reintroduction, geographical situation, infrastructural facilities, etc.) on one hand and on the management of an economic entity that manages the business operations on the other the analysis of economic effects has been conducted in four economic entities.

The objective of the paper is to make an analysis of the game profit and profit per 100 hectares of total surface of hunting ground usedin three regions of Serbia,byanalyzing the four users of hunting grounds among which the two are in the same region but with different intensity of management. On the basis of the analysis of game profit the possibilities of increasing a direct profit in hunting groundswill be determined.

Material and methods

The analysis was conducted in the three regions of Serbia, in four hunting grounds among which the two are in the same region but with different intensity of management. *Takovo* hunting groundmanaged by the Hunter`s Association *Vojvoda Milan Obrenović*from Gornji Milanovacis characterized by its height above sea level ranging from 240 to 1132 meters being the highest peak of Rudnik Mountain. Bearing in mind a huge surface of this hunting ground which covers74,292 hectares *Takovo* hunting ground has good conditions to raise roe deer, wild boar, hare and field partridge while pheasant is mostly reintroduced from an artificial production (www.lovgm.org).

The *Gučevo* Hunter`s Association from Loznica belongs to a Mačvanski hunting district and it manages *Jadar* hunting ground of total surface of 45.417 hectares out of which 38.000 hectares is a hunting area.This hunting association manages following game species: roe deer, wild boar, hare and pheasant (www.lss.rs). *Minićevo* Hunter`s Association belongs to Zaječarski hunting district and manages the *Klisura* hunting ground of total surface of 20.206 hectares out of which 18.014 hectaresis a hunting area. This hunter`s association manages following game species: roebuck,roe deer, wild boar, hare, pheasant, field partridge, quail and woodcock. (www.lss.rs). *Salaš* Hunter`s Association from Salaš manages *Dubrava* hunting ground. A hunting area of hunting ground is 35.474 hectares and belongs to a hilly-mountainous type of hunting ground. This hunting ground manages small and big game. Big game includes roebuck, roe deer and wild boar. Small game includeshare, pheasant, field partridge and quail.

The game species which the majority of hunter`s associations manage, as the users of hunting ground (nearly 90% of total surface of Serbia), make profit of and are the most represented in hunting grounds were included in the analysis. Among a small game included in the analysis for the purposes of this research paper are: hare, pheasant, quaint, mallard, wolf and fox while the big game includes roe deer and wild boar. Roebuck was not included into the analysis since it is raised only in several hunting grounds used by hunter`s associations while in *Klisura* hunting ground this species of game was not harvested at all.

The records on the abundance of wild game (optimal and registered breeding stock, planned and realized game bag record) in these hunting grounds were provided from a central data basis of the Ministry of Agriculture, Forestry and Water Management, of the Directorate of Forestry that keeps records in line with the Law on Game and Hunting (2010).

The prices of game bag record were calculated according to the price list of the Hunter`s Association of Serbia for 2017/18 for doe while for small game and wild boar with 30% discount of this commercial price list taking into account that these game species are shot by the members of hunter`s associations for whom this discount is envisaged by a price list and every association takes this advantage. Trophy value of game bag records in roebuck and wild boar in analyzed hunting year was obtained from hunting ground users.

A method of description, comparative method (applied for comparing abundance of big and small game, income derived from game bag records among the four different hunting grounds)and method of descriptive statistics were used during elaboration of present research paper. Selected parameters are displayed in tables and by means of graphic representation for better survey of phenomena analyzed.

Results and discussion

Management of a hunting ground represents a set of measures for protection, managing, hunting, exploitation and improvement of game populations in hunting grounds along with a protection, preservation and improvement of animal habitat. The goal of hunting management is to provide and save wild game populations by their raising, protecting and rational exploitation for future generations of users (Beuković, Popović, 2014).

According to game species and categories the Table 1 shows an optimal and registered breeding stock as well as planned and realized game bag record in 2017/18in four hunting grounds: *Takovo, Jadar, Klisura* and *Dubrava*. Big game in all hunting grounds includes roe deer and wild boar. As for the abundance these species are the most abundant in *Takovo* hunting ground where 1776 animals are raised. *Takovo* hunting ground also has the most abundant small game amounting to 15,953 animals what is explained by the fact that this hunting ground covers the largest hunting area. As for the realized game bag record in big game it is the highest in *Dubrava* hunting ground.

Table 1. Survey of the abundance of game stock, planned and realized game bag records in 2017/18 in Takovo, Jadar, Klisura and Dubrava hunting grounds.

Hunting ground	Game species	Roebuck	Roe deer	Fawn	Wild boar	Sow	Piglet	Hare	Pheas-ant	Quail	Mallard	Wolf	Fox
Takovo	Optimal stock	629	629	442	23	23	30	4200	3500	7000	500	3	800
	Registered breeding stock	629	629	416	22	22	30	3500	5000	6200	450	3	750
	Planned game bag record	128	112	30	12	10	14	320	1420	650	50	1	280
	Realized shooting	128	39	11	12	10	14	164	1275	630	40	0	250
Jadar	Optimal stock	270	270	180	34	34	32	2000	3320	0	0	0	0
	Registered breeding stock	275	275	170	26	26	20	1650	2590	3000	3000	4	650
	Planned game bag record	61	61	26	2	2	10	300	3252	250	250	1	240
	Realized game bag record	59	59	0	1	0	0	205	1594	178	124	0	140
Klisura	Optimal stock	137	137	76	38	38	74	720	270	1500	500	15	100
	Registered breeding stock	137	137	76	38	38	74	720	270	1500	500	15	130
	Planned game bag record	17	23	24	13	13	74	108	109	150	0	5	40
	Realized game bag record	8	19	0	13	13	74	19	0	0	0	5	40
Dubrava	Optimal stock	380	380	240	50	50	50	2250	900	3000	150	10	150
	Registered breeding stock	365	365	230	50	50	50	2200	900	3000	200	12	200
	Planned game bag record	64	64	16	19	19	84	280	465	400	50	4	50
	Realized game bag record	64	24	40	16	16	78	152	350	350	32	4	50

Source: Authors research

The game abundance varies depending on game species (big or small game), as well as on certain regions of Serbia (Popović, 2006). According to the Law on Game and Hunting enacted in Serbia in 2010 it is allowed to reintroduce game into hunting ground only if it does not endanger a biological balance and diversity. The reintroduction of game into hunting ground can be done up to the number of optimalgame stock determined by a plan projectand in Serbia it is now conducted in pheasant in a number of hunting grounds.

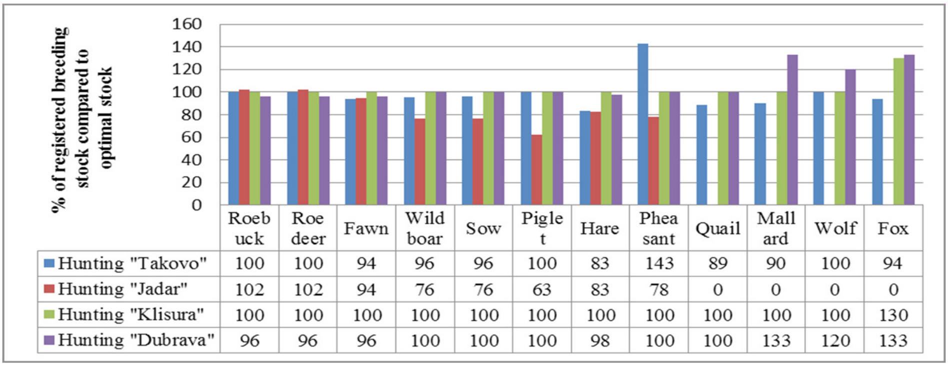
A roe deer has a special economic importance for Serbia since its economic benefit is derived from all three determinants of hunting value (trophy, game bag recordand animal body mass). Roe deer is an autochthonous representative of wild ungulates and populates over 90% of total hunting area of Serbia (Popović, Gačić, 2005).

In Table 1 we can observe that the largest number of roebuck trophies was harvested in *Takovo* hunting ground - 128,and the least in *Klisura* hunting ground - 8 trophies in ananalyzed hunting year. There is a difference in the share of trophies of various body masses in given hunting grounds. Thus in *Takovo* hunting ground the most trophies were of the body mass of up to 249.0 gramswhile in *Dubrava* hunting ground a few trophies of the mass of 500.0 – 549.0 grams were harvested while in the other hunting grounds there were no trophies of these body masses. Taking into account that the trophies are paid according to the price list on the basis of their masses the highest incomes are likewise realized from the trophies of the largest body masses. The abundance of pheasant is above optimal stock in *Takovo* hunting ground while the percentage of fawn, wild boar,sow, hare, quail and fox is belowoptimal stock. In *Jadar* hunting ground thenumber of fawn and roe deer exceeds the optimal stock of wild game. The optimal harmony of registered breeding stock and optimal stock in majority of game species is observed in *Klisura* hunting ground except for a fox in which inalmost all hunting grounds the abundance is above the optimal stock. In *Dubrava* hunting ground percentage of registered breeding stock inroe deer (all categories) and hare is below an optimal stock (Graph 1).

On the basis of trial results it is perceived that spring feeding of pheasant has no effect on pheasant reproduction. On the contrary, feeding the juvenile birds upon their reintroduction into a hunting ground and feeding the pheasants in winter can be highly significant for their body fitness and survival. Certainly, besides these measures, the greatest contribution to preserving the abundance of pheasant population is their raising in pheasant farms and populating in hunting grounds in an appropriate age (Popovićet al., 2011).

On the basis of data in Table 1 that show the optimal and registered game breeding stock in *Takovo, Jadar, Klisura* and *Dubrava* hunting grounds in 2017/18 a percentage of registered breeding stock for these four hunting grounds was represented by means of a graph. As for the percentage of realisation of game bag record it can be seen from Graph 2 that in *Takovo* hunting ground 100% realisation was obtained in roebuck, wild boar, sow and piglet. In *Jadar* hunting ground roebuck and roe deerwere 97% realised, wild boar 50%, hare 68%, pheasant 49%, quail 71% andfox 58%. In *Klisura*hunting ground in some planned game species there was no game bag record(fawn, pheasant, quail and mallard).In addition, fairly high percentage of realised planned game bag recordis observed in the category of fawn in *Dubrava* hunting ground.

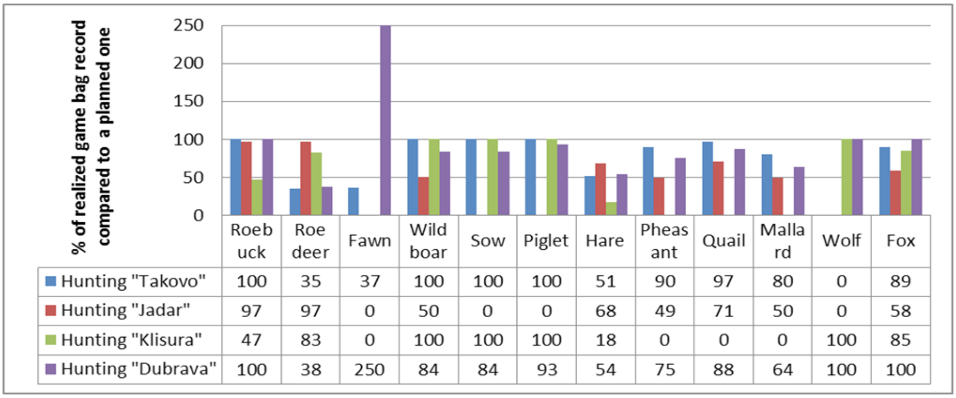
Graph 1. Percentage of registered breeding stock of wild game compared to optimal stock for 2017/18 in Takovo, Jadar, Klisura and Dubrava hunting grounds.



	Roebuck	Roe deer	Fawn	Wild boar	Sow	Piglet	Hare	Pheasant	Quail	Mallard	Wolf	Fox
Hunting "Takovo"	100	100	94	96	96	100	83	143	89	90	100	94
Hunting "Jadar"	102	102	94	76	76	63	83	78	0	0	0	0
Hunting "Klisura"	100	100	100	100	100	100	100	100	100	100	100	130
Hunting "Dubrava"	96	96	96	100	100	100	98	100	100	133	120	133

Source: Authors research.

Graph 2. Percentage of realized game bag recordin wild game for 2017/18 in Takovo, Jadar, Klisura and Dubrava hunting grounds.



	Roebuck	Roe deer	Fawn	Wild boar	Sow	Piglet	Hare	Pheasant	Quail	Mallard	Wolf	Fox
Hunting "Takovo"	100	35	37	100	100	100	51	90	97	80	0	89
Hunting "Jadar"	97	97	0	50	0	0	68	49	71	50	0	58
Hunting "Klisura"	47	83	0	100	100	100	18	0	0	0	100	85
Hunting "Dubrava"	100	38	250	84	84	93	54	75	88	64	100	100

Source: Authors research.

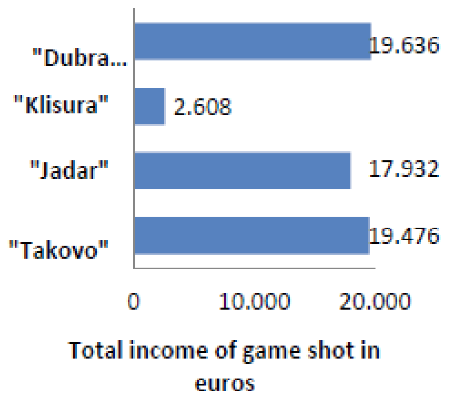
By interviewing the hunters (Lavadinović et al., 2020) the wild boar is recognized as the most hunted big game in Serbia and the second most popular way of hunting among domestic hunters. Shooting of wild boar is used as one of the ways for decreasing the volume of damage and for alleviating the economic consequences being at the same time attractive to hunters because of the trophy, tasty meat and different methods of hunting but for respecting the hunting tradition as well (Quirós-Fernández et al., 2017).

It was determined that the highest total revenue of game bag recordin 2017/18 realised *Dubrava* hunting ground amounting to EUR 19,636 while the least value of revenuewas realized by *Klisura* hunting ground amounting to EUR 2,608 (Graph 3). A big oscillation in revenues of game bag recordbetween these two hunting grounds is explained by the fact that in *Klisura* hunting ground there was no high game bag recordrealized in observed hunting year as shown in Table 1. *Dubrava* hunting ground realized highest income infawn value even EUR 14,350 in which the highest income was realized in the trophy of the mass of 500,0 – 549,0 grams. In *Jadar* hunting grounda very high value was realized by small game amounting to even EUR 10,697.7. *Takovo* hunting ground realized an almost equalized value in big and small game. The value of big game was EUR 9.829 and of the small EUR 9.646,5. In this hunting ground even 99 fawn were game bag records in the trophies of the mass of up to 299,0 grams whose price is substantially smaller compared to the price of trophy of 500,0 – 549,0 grams.

Body mass does not affect the quality of the roebucks antlers while the age at the time of shooting has a statistically significant effect. Roebucks are shot far too young and by such inappropriate behaviour it is not possible for individual animals to develop antlers up to a maximum trophy value (Uroševićet al., 2013).The mass of trophy increases with the age of individual and reach its culmination in the seventh year. The most quality antlersare found in six or seven years old animals when the shooting should take place (Popovićet al., 2020).

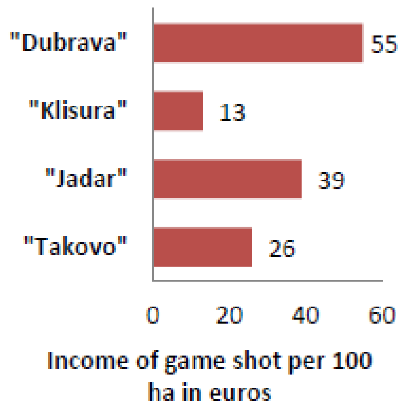
In order to obtain the most possible real idea of profit of these four hunting grounds the profit per 100 ha of total surface of hunting ground was analysed (Graph 4). *Dubrava* hunting ground realized profit of EUR 55 per 100 ha of total surface followed by *Jadar* hunting ground realizing EUR 39 euros, *Takovo* hunting ground achieving EUR 26 and *Klisura* hunting ground EUR 13.

Graph 3. Total income of game bag record in 2017/18 in Euros for Takovo, Jadar, Klisura and Dubrava hunting grounds.



Source: Authors research

Graph 4. Income per 100 ha from game bag record in 2017/18 in Euros for Takovo, Jadar, Klisura and Dubrava hunting grounds.



Source: Authors research

By disturbing the roebuck age structure in favour of the class of juvenile or middle age animals the possibility of maintaing continuity of management and optimal game bag record inroebucks in the class of mature animals is being violated (Popović et al. 2007).

The harvest value can be considerably increased by reducing the share of illegal hunting and poaching, degree of keeping regular records on hunted animals, by increasing the quality of trophy as well as by increasing the degree of exploitation of given game species through hunting tourism *(Ranković and Popović, 2002)*.

With minimum expenses in certain time period the goal is to obtain the best possible success in management by using all the measures for attaining optimal abundance in wild game (Kečaet al., 2018).

Analysing the factors which the results of management of populations of economically most important species of wild game in hunting grounds depend on with the view of enhancing economic effects of management of more important species of hunting game Tomić et al. (2007) conclude that the activities must be directed to those factors which the results of management depend on either directly or indirectly. First of all the losses in reproductive period in wild game species should be decreased and the degree of exploitation of some game populations adapted in respect to specificities of certain regions.

A significant improvement of the economic results of management of game populations can be fulfilled improving the way of management i.e. by moving the relevant parameteres (growth rate, losses, trophy quality) towards the acceptable biological limits. This is indicated by a research on registered breeding stock of roe deer in Serbia during the 2003/4 hunting business year (*Tomić et al.,* 2005).

According to the research of Popović et al. (2014) the increase of the economic returns can be achieved by valorisation of production where game bag record would be payed per price list of theHunter`s Association of Serbia (www.lovacki-savez-srbije.org) at the prices for"tourist hunters", in which case profit of the economical coefficient of 1.54 would be realised. However,-due to contemporary conditions in the market and poor payment possibilities of hunters it is still impossible to achieve.

Conclusion

On the basis of management of four hunting grounds named *Takovo, Jadar, Klisura* and *Dubrava* whose total profit of game bag records in big and small game was analysed as well as profit per 100 haof total area realised in 2017/18 it was determined that there is a room for profit to be increased.

Improvement of the economic results of management of big and small game populations can be fulfilled by improving an age structure of population of roe deer, increasing the share of roebucks with trophy masses of over 450 grams, by decreasing the losses and increasing real growth rate in some game species within the acceptable biological limits.

The increase of the value of game bag records can be only slightly increased by the increase of registered breeding stock taking into consideration that registered breeding stock range from the values of optimal stocks and those immediately below this optimum.However, a realized game bag record is much below a planned one therefore the reasons must be identified why the envisaged plan was not being fulfilled.

The profit per surface unit varies considerably among the hunting grounds and among the hunting grounds in the same region and dependsa great deal on the intensity of management of game species populations in hunting grounds.

Literature

1. Adamič, M., Rapajić, Ž., Popović, Z., Kunovac, S.,Oprivica, M., Soldo, V., Marković, B.,Maunaga, Rada., Mićević, M., Ilić, V. (2006): *Ugrožene vrste divljači u Bosni i Hercegovini.* Banja Luka, pp.94.
2. Beuković, M., Popović, Z. (2014): *Lovstvo*, Univerzitet u Novom Sadu, Poljoprivredni fakultet Novi Sad, str. 103.
3. https://urospetrovic875021073.files.wordpress.com/2018/05/cenovnik_lovna_2017_2018_godina.pdf Lovački savez Srbije , *Cenovnik 2017/18.*, (15.09.2020).
4. Keča, LJ. ,Lazarević, D., Marčeta, M. (2018): *Ekonomski efekti gazdovanja srnećom divljači na primeru lovačkih udruženja iz* Šumadije, Šumarstvo 3-4, 169-178.
5. Lavadinović, V. M., Popović, Z., Beuković, D. M., Cokoski, K. (2020): *Gazdovanje divljom svinjom (Susscrofa L.),* Glasnik *Šumarskog* Fakulteta, 121, 47-59.
6. Popović, Z. (2006): *Gazdovanje populacijama divljači u ulovištima Lovačkog saveza Srbije*. Biotehnologija u stočarstvu, 22: 113-128.
7. Popović, Z., Beuković, M., Đorđević N. (2008*.): Brojnost i stepen korišćenja populacija divljači u lovištima Lovačkog saveza Srbije*. Biotechnology in Animal Husbandy 24 (spec.issus), p. 11-23.
8. Popović, Z., Beuković, M.,Đorđević, N. (2012): *Gazdovanje populacijom zeca (Lepus Europaeus Pall.) u Srbiji*, Međunarodni simpozijum o lovstvu, "Savremeni aspekti održivog gazdovanja populacijama divljači" Zemun-Beograd, Srbija 22. – 24. Jun, UDK:639.112.
9. Popović, Z., Davidović, V., Božičković, I., Stojanović, B., Ivanović, B., Bojanović Rašović, M. (2020): *Change of antlers morpho-metric parameters and total trophy score in roe deep (Capreoluscapreolus l.) in relation to age*, Biotechnology in Animal Husbandry, vol. 36, br. 2, str. 225-237.
10. Popović, Z., Đordević, N., Beuković M., Perišić P. (2007): *Models for management of roe deer populations in various conditions.* International Symposium: Sustainable forestry – problems and challenges; Perspectives and challenges in wood technology.Ohrid, Macedonia, 24.-26.10.2007 Proceedings, 232-236.
11. Popović, Z., Đorđević, N., Beuković, M., Beuković, D., Đorđević, M. (2011): *Uticaj ishrambenog potencijala i agrotehnike na brojno stanje zeca i fazana u lovištima Srbije*. Međunarodni naučni simpozijum agronoma „Agrosym Jahorina".

12. Popović, Z., Gačić, D. (2005): *Trofejna vrednost i starost srndaća u različitim tipovima lovišta*. Zbornik kratkih sadržaja simpozijuma sa medjunarodnim učešćem "Stočarstvo, veterinarstvo I agroekonomija u tranziconim procesima", str. 47.
13. Popović, Z., Živković, D., Lavadinović, V. (2014): *Microeconomic analysis of game population management in hunting grounds*. 3rd international symposium on hunting "Modern aspects of sustainable management of game population". 26-28.09.2014 Beograd. Proceedings 89-95.
14. Quirós-Fernández F., Marcos J., Acevedo P., Gortázar C. (2017): *Hunters serving the ecosystem: the contribution of recreational hunting to wild boar population control*, European Journal of Wildlife Research 63 (57).
15. Ranković, N., Popović, Z. (2002): *Dinamika odstrela i vrednost izlova nekih vrsta divljači u Srbiji*. „Međunarodni simpozijum Stočarstvo i agroekonomija u procesima tranzicije". Savremena poljoprivreda, (3-4)195-198.
16. Tomić, R., Popović, Z., Perišić P. (2007): *Uticaj promene uzgojno-eksploatacionih parametara na ekonomske efekte gazdovanja srnećom divljači*. Savremena poljoprivreda, br.1-2; str. 212-217; Novi Sad.
17. Tomić, R., Popović, Z., Perišić, P.(2005): *Ekonomski efekti gazdovanja srnećom divljači u multifunkcionalnom razvoju ruralnog područja Srbije*. Međunarodni naučni skup „Multifunkcionalna poljoprivreda i ruralni razvoj". Tematski zbornik, 292-299.
18. Urošević, M. M, Drobnjak, D., Matarugić, D., Živković, B., Urošević, B. M. (2013): *Uticaj starosne dobii mase tela na trofejnu vrednost rogovlja srndaća (Capreolus capreoulus L.)*, Agroznanje, 14(1), 59-67.
19. Lovačko udruženje Vojvoda Milan Obrenović, www.lovgm.org (17.09.2020).
20. Lovački savez Srbije, www.lss.rs (15.09.2020);
21. Zakon o divljači i lovstvu (2010): (Službeni glasnik RS", broj 18/10).

ROMANIAN AGRICULTURAL RESEARCH AND THE VIABILITY OF FARMING SYSTEMS

Marilena Potârniche Berheci[1]

Abstract

Ensuring the viability of agricultural systems, set up to obtain crop and animal production, requires balancing them in economic terms, on the basis of strong ecological foundations and approaches to the optimum exploitation of biological assets, thus creating the conditions for abundant and constant crops, with increasingly efficient productivity.

The discussed topic, sustainable agricultural development, was dealt with in the literature by a number of theorists who generally drew attention to the impact on the environment of society and the economy. Experts' conclusions on the continued widespread use of intensive farming based solely on industrialization and chemically-intensive methods, show that these are not the solution to sustainable economic development.

The solution found in sustainable agriculture is proving to be the viable alternative to intensive agriculture, as being essential to promote environmental systems and technologies, responsible also for meeting the needs of future generations to develop harmoniously by focusing on maintaining and improving the viable Romanian varieties of crops.

The aim of this work is also to highlight the link between the changes in the Romanian agriculture, in the context of the implementation of the European agricultural policy, the integration within the common market, and the progress made in the degree of implementation of information technology within Romanian farms.

Key words: *agricultural systems, sustainable agriculture, intensive farming, eco-biological products.*

Introduction

The National Rural Development Program 2014 – 2020 (PNDR) is a program through which non-reimbursable funds from the European Union and the Romanian Government are granted for the economic and social development of the rural areas in Romania.

1 Marilena Potârniche Berheci, Ph.D. student, Bucharest Academy of Economic Studies, sector 1, Piata Romana no. 6, Bucharest, Romania, E-mail: marilenaberheci@gmail.com

During the 2007 – 2013 and 2013 financial years, the National Program for Rural Development included research and extension programs on agri-pedo-climate risk management by climate related derivate. Applied research and the implementation of sustainable management of pollutant emissions in poultry farms, water quality, air quality and manure stabilization was also a research program financed to preserve the quality of soil, water and air resources.

The development of new organ-mineral fertilizers and the implementation of an integrated way to manage them whilst protecting the environment and preserving and using natural resources sustainably represented scientific research in line with the common agricultural policy with the aim of achieving and implementing integrated bio refining complexes by 2050.

In Romania, agricultural research is aimed at promoting the agrochemical industry and intensive large-scale agriculture. This role can be achieved in a coherent way through the scientific approach, enhancing the relationship between the results achieved in the agricultural exploitation area, the economic environment, and the work carried out in this area through research. However, agriculture is an area of very little study by researchers, in terms of the impact of innovation on the performance of economic entities which operate directly or indirectly in this field.

The economic system is a living, dynamic system and is based on innovation. The drive for innovation is a challenge for businesses in all economic areas, and those companies that do not keep up with change risk being driven out of the market, either due to the lack of competitiveness of their product portfolio or because of production costs that are too high.

As the key of the economic environment is economic activity, the intention of research is mainly focused on studying the relationship between capital -innovation-performance at the micro-economic level, through a methodological and informational triangulation. An important challenge in the current economic system is the ability of economic entities to innovate, as economic and financial performance increases, and also to combat the effects of climate change.

Research data and methodology

The main data sources for all sectors of the bio-economy presented in the following analysis are INSSE, Eurostat.

Agricultural research touches on all aspects of production, processing, packaging, transport, storage and distribution. During the past few decades, most

European countries have experienced reduced birth rates and an aging population. Romania is no exception to this trend, marked in recent decades by a continuous and significant population decline. In this context, taking into account the percentage of budget expenditure allocated to this category in recent years, we can see that agricultural research has been side-lined among the national priorities (Manescu & Ana Mariana Dincu , 2016).

According to the INS, projects for the general promotion of knowledge through R&D for agricultural sciences, financed through the General University Funds (GGF), fell yearly as a share of total projects funded, from 4,3% in 2011 to 2,15% in 2018.

Research institutes are a form of institutional organization specific to research activities, created with the aim of maintaining the conduct of these activities, and the development of scientific and technological competition in areas of national interest. National research institutes are legal entities whose main purpose is research activity. They work on the basis of economic management and financial autonomy, and maintain economic accounts (National Institute for Agricultural Research and Development, 2007).Research institutions are important elements of structures that support access to research results in the economic area. Recent changes in the economic environment will make these institutions much more important in the near future (Mazzoleni & Richard R. Nelson, 2007).

In accordance with the provisions of the Law on Scientific Research and technological Development, national R&D institutes, as a specific institutional form, participate together with the other institutions in the conduct of R&D activities, with access to the budgetary resources destined for this purpose, and other resources made directly available by the beneficiaries. To ensure food security, the health of the population, the only solution is to build sustainable and competitive agriculture based on well-functioning farming systems.

Intensive or industrial farming	It is the system of large, resource-intensive land areas, equipped with a diversified technical level mechanization. With remarkable yields, this system provides raw materials and fresh products in large quantities throughout the year, because the productive activity takes place on large, compact areas.The structure of the crops in this structure is very varied, the crop rotation systems are modern and the technological process is supervised by highly qualified specialists. The system is a great consumer of fuel, energy, fertilizers and pesticides.

Chemical farming	With high productivity, it enables a wide range of foods to be obtained in relation to the nutritional needs and tastes of consumers of variety that cannot be found in the traditional system. The negative environmental impact is significant and with long-term impact. This is a system located on the opposite side, of so-called organic farming" mechanization and the use of chemicals cause disaggregation of agricultural ecosystems and "genetic erosion" especially in industrially and economically developed countries. Paradoxically, agriculture as the most ancient ecological occupation has become to a certain extent non-ecological, especially through the massive penetration of chemistry and impact with polluting industries.
Organic farming	The system is based on natural fertilizers – organic fertilizers in the form of manure, compost, green fertilizers, and so on. Research in different countries shows, for example, that stimulating the activity of nitrogen-fixing bacteria on the roots of leguminous plants, especially soya, can provide a biological nitrogen input of 50-150 kg/ha. In the United States, large-area soybean cultivation is extended to provide 10 million tons of nitrogen per year by bacteria. Green fertilizers, through lupine, sainfoin, vetches, can replace 20 tons of manure per hectare, or 250 kg NPK/ha as a result of their decomposition.
Sustainable agriculture	The concept involves the practice of alternative production in the broad sense of the word, moving gradually from purely biological to sustainable and biologically integrated. It must make full but judicious use of the achievements of chemistry, machinery and biology to increase crop yields. The contribution of chemical fertilizers and pesticides to crop growth must not exceed 40 to 45 %, and the idea of sustainable agriculture is to increase productivity with secure and constant profits. With minimal environmental damage and ensuring the food security of the population, it is based on the application of technologies to soil and climatic diversification of the various zones. This implies a laborious concept that prescribes the complexity of the system for biological stability of plants, The FAO considers that "for sustainable development, natural resources must be designed and preserved, and technical and institutional changes must be made in such a way as to preserve natural resources and to ensure that they are made available to the public. to meet the needs of current and future generations.

Organic farming	It optimizes the general concept of a possible future alternative in agricultural ecosystems, but it also contains its own original elements. First, it ensures the integrity of the food chains and keeps the stability of biogeochemical cycles for the main elements of soil fertility intact. However, some crop - polluting techniques are recorded in this system, used in certain farms, which control products, particularly perishable and fresh consumables, in the field, in warehouses and in store by means of specific laboratory tests. The organic farming system integrates into the biosphere and largely excludes means of external control (pesticides) of the ecosystem and ensures greater resilience of the biological community to external aggression (diseases and pests). In addition, the whole complex of classical agro-technical measures is: Land-use, mixed crops, green manure, organic and agro-technical control, irrigation, mechanization, which is applied on strict agro-biological criteria to protect the soil as far as possible. This system focuses on the choice of varieties which are more easily adaptable to the climate and soil, creating more resistant genetically modified varieties to diseases and pests, on the severe selection of seed and propagating material, and on the less polluting and energetic crop system. In the main industrial States and with advanced agriculture, governments support clean, healthy agri-food production with higher nutritional principles.
Agricultur-al eco-systems	An integrated organic complex of natural, economic and social factors, which requires rational, scientific intervention by the grower, leading to higher productivity, protection and cost-efficiency, based on superior parameters of contemporary technology, making full use of the mechanisms of market economy.

The analysis of data published by Eurostat for 2008, 2013, 2014 and 2015 shows that the turnover of the total bio-economy (including food and drink and the primary agriculture and forestry sectors) in the EU-28 has continuously increased from EUR 2,09 trillion to EUR 2,28 trillion. Around half of this comes from the food and drink sector, almost a quarter of turnover is produced by the primary sectors (agriculture and forestry), while the other quarter is produced by so-called bio-based industries (such as chemicals and plastics, pharmaceuticals, paper and paper products, forest-based industries, textiles, biofuels and bioenergy). The food sector in particular made a significant contribution to the increase in turnover.

Nguyen *et al. (YEAR)* address the impact of nanotechnology on ensuring high efficiency and qualitative agricultural processes. They consider that nanotechnology is monitoring a process of top-level agricultural control, in particular through its miniature size. In addition, many potential benefits such as improving food quality and safety, reducing embedded agricultural resources, enriching nano-based nutrients in the soil, etc. allow nanotechnology to be applied with a resounding weight.

The significant interests of the use of nanotechnology in agriculture include specific applications, such as nano-fertilizers and nano-pesticides, to track product and nutrient levels, to increase productivity without the decontamination of soil, water and protection against more harmful insects and microbial diseases. Nanotechnology can act as a sensor for monitoring soil quality in agriculture and thus maintain the health of agricultural plants

The intelligent farm and the exceptional potential of using smart resources in their management were addressed by Bushmann *et al.* in 2017. The development of robotic cars for agricultural purposes, such as mechanical casting, fertilizer application or fruit harvesting and the development of unmanned aerial vehicles with autonomous flight control, together with the development of light and strong hyper-spectral instantaneous chambers which can be used to calculate biomass development and fertilization status, opens the door to sophisticated farm management. Moreover, decision tree models are now available, which allow farmers to distinguish plant diseases on the basis of optical information. Virtual fence technologies allow herd management based on remote sensing signals and sensors or action devices attached to animals. Taken together, these technical improvements constitute a technical revolution that will bring about disruptive changes in agricultural practices.

Research methodology Romanian agriculture versus European model; structure and resources

The structure of Romanian agriculture in the last century has become highly polarized. According to the 2010 agricultural census, the usable area of the agricultural holding covers 13.3 million hectares, with 3.9 million agricultural holdings with an average area of 3.4 hectares identified.

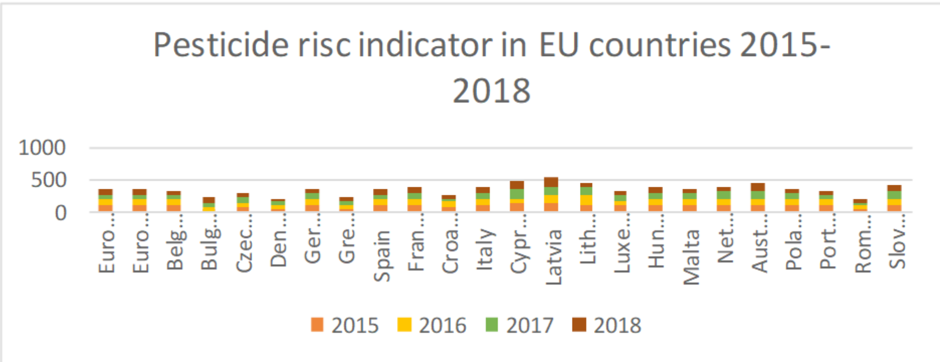
The area cultivated in 2019, compared to 2018, has grown both in total (+154.8 thousand ha) and in the mostly private sector (+156.1 thousand ha). Although one third of farms (33%) developed on the 171 hectares of land in the European Union (used in agricultural production as of 2016) were in Romania, more than 3 million of these were on areas smaller than 1 hectare (EUROSTAT for 2016).This exploitation model explains why Romanian agriculture is only an alternative target for the agrochemical industry. In general, small-producer holdings represent a very large area and are therefore perceived as having a high potential for exploitation. They are targeted by the owners of large-scale farms oriented toward intensive monocultures and exports, which use intensive plant protection products and marketable propagating materials. As a result, these agro-chemical multinationals that have been established in Romania prefer to reduce the number of farmers and consolidate them on agricultural exploitations.

The expectations for agricultural research in Romania are linked to making it more effective to contribute to eradicating "uncompetitive agriculture" and achieving high-performance agricultural production, ensuring the development of a sustainable, sustainable model of agriculture. However, the programs carried out have shown that the private economic area is financing agronomic research projects that are fully geared toward intensive production.

The harmonized risk indicator 1 for pesticides through the classification of active substances (Directive 2009/128/EC) (online data code: AEI_HRI) at European level reflects a lower average risk level for Romania.

Graphically, the pointer is mirrored as follows:

Graph 1. Harmonized risk indicator for pesticides (HRI1) by group of active substances.



The studies they carry out help to classify micro-enterprises as those with the back aspect of production. They shall preventively undermine any initiative or exposure that could bring added value to micro-enterprises through other organizational modes. For example, smaller distribution channels, certification as organic producers, etc. (Altieri et al., 2011; Levidow et al., 2012).

The contribution of agriculture to the formation of GDP

Although it has a relatively good result and a positive influence of 0,4 % points on the observed economic growth of 4% in 2018, the share of agriculture in gross value added remained below 5%. As a result of the rather weak exploitation of crop production and the rebound in livestock farming, food imports have been steadily advancing in recent years. The cultivated area in 2019, compared to 2018, has grown both in total (+154.8 thousand ha) and in the mostly private sector (+156.1 thousand ha).

According to INSSE, the result of trade within the food area was of -1.86 billion euros in 2018.In external food trade, coverage fell to 83% in 2016,only 75% in 2017, and to around 70% in 2018. This is where it remained in 2019 after the first eight months, the period during which a sectoral deficit of around EUR 1,4 billion had already accumulated.

Romania has 95 institutes and 19 research centres under the Ministry of Research and Innovation (MCI), the Romanian Academy (AR) and other ministries.

State of play of agricultural research. Situation of research institutes in Romania

The Romanian national R&D institutes operate in accordance with the principles of the Government Decision No 587 of 21 May 2003 approving criteria and methodologies for the evaluation and accreditation of the component units of the R&D system of national interest It also applies the methodology of attesting the ability to carry out R&D activities by units or institutions other than accredited higher education institutions and their subordinate units and institutions subordinate to or coordinating the Romanian Academy and branch academies.

In accordance with the stipulations of the Law on Scientific Research and technological Development, national R&D institutes, as a specific institutional form, participate together with other institutions in the conduct of R&D activities, with access to the budgetary resources earmarked for this purpose, as well as other resources made directly available by the beneficiaries.

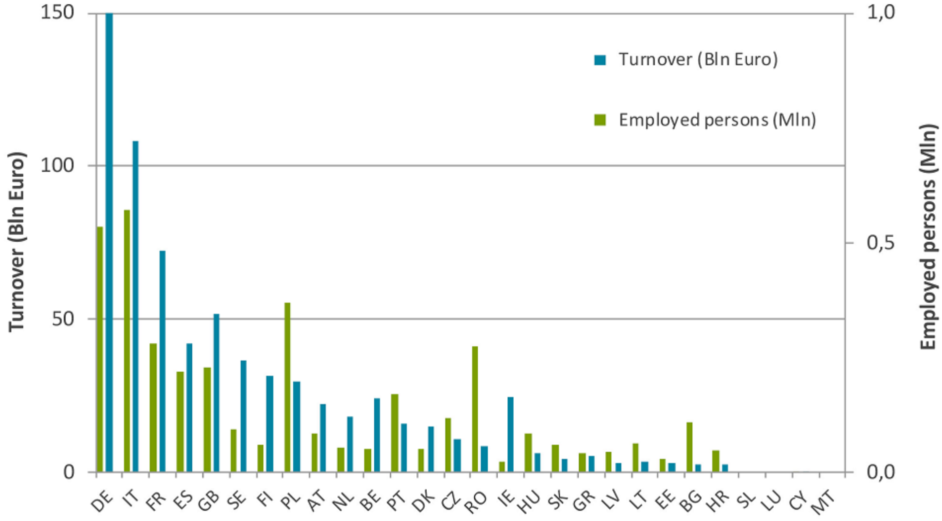
Turnover and employment in the bio-economy in the EU Member States per Member State (EU-28, 2015)

The following graph compares total turnover and employment in the economy based on bio-procedures (excluding agriculture, forestry, fisheries, food, beverages and tobacco products) for each Member State of EU-28 in 2015. The figure shows clear differences between groups of Member States, e.g. Eastern European countries (Poland, Romania and Bulgaria) are apparently stronger in fewer sectors with added value of the bio-based economy, which generate a lot of jobs.

In comparison, the countries of Western and Northern Europe generate a much higher turnover in comparison to the generated level of employment. The countries with the largest relative differences between turnover and employment in 2015 are Ireland, Finland and Belgium.

Turnover and employment in the EU bio-economy per Member State 2015

Graph 2. Turnover and employment in the EU bioeconomy per Member State 2015.



With regards to the level of training of farmers in 2016, 31,6% of farms in the EU managers said they had received some kind of agricultural training, but only 9,1% have completed a full agricultural training cycle. All other farm managers (68,3%) learnt their profession through practice only experience. At a Member State level, Luxembourg (52,8%), Czech Republic (38,7%), France (34,9%), Latvia (31,3%), Estonia (28,6%) and Poland (27,4%) recorded the highest shares of farm managers who have completed a full cycle of agricultural training. Practical experience as the sole basis for management of an agricultural holding is particularly widespread in Romania, Greece and Bulgaria, where more than 90% of farmers have not been engaged in any agricultural learning/training/teaching activity.

Full agricultural training is the most common (21,7%) among the youngest farmers in the EU (under 35). France (71,7%) and Luxembourg (68,8%) have the highest share of fully trained young farmers. However, 55,5% of young farmers in the EU-28 have still relied only on practical experience in 2016, especially in Romania (89,6%), Latvia (77,7%) and Bulgaria (77,3%). Practical experience-based agriculture is particularly dominant (72,6%) among older farmers (55 years and older). Romania, Greece, Bulgaria and Croatia had all over 90% of older farmers without any agricultural training. Around half of farmers over 55 years of age received full agricultural training in Luxembourg (44,0%), while 93,2% of farm managers completed basic agricultural training in Italy and 67,3% in the Netherlands and 53,5% in Germany. While the prevalence of full training among young farmers is all the more positive, there is still much room for improvement.

Economic and financial situation of national agricultural research institutes

The revenues of the national R&D institutions shall consist of: income from basic activity, income from related activities and budget allowances for capital expenditure. The substantial differences between research institutions, both in terms of the level of resources provided in terms of capital and total revenues and in terms of budget revenues, affect their comparability in terms of economic and financial performance.

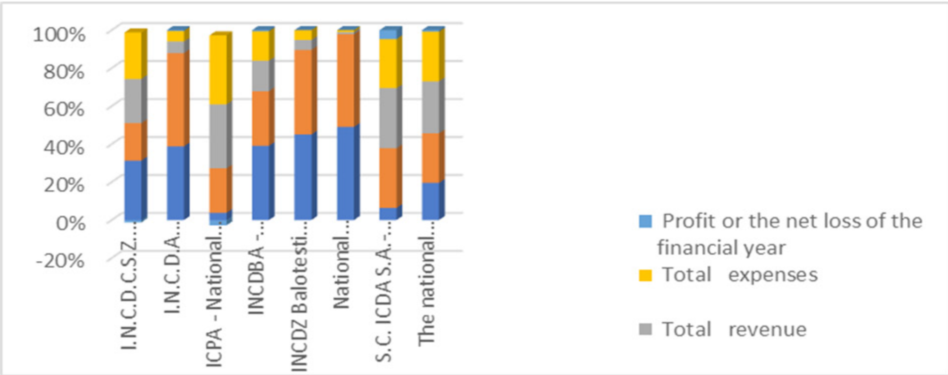
The principles of allocation relating to budget allocations for capital expenditure should also be examined and allocated as a matter of priority, to institutes which have the capacity to attract other funds from direct contracts or European contracts, or to those which are supported for the most part by budget appropriations.

We appreciate that this is a decision of the utmost importance and it aims to establish the flow of budget allocation to the best performing research institutions, which in turn have the capacity to attract other funds, or to those institutes for which surplus budget allocation is the only way to maintain their existence

The objective of the analysis tends to determine whether this principle of efficiency of public spending can be linked to research strategy elements at national or sectoral level. Such a situation shows that the core strategy of INCD, which achieves revenues from related activities at more than 20% compared to the revenues from core activities, is to obtain a substantial part of the revenues from budgetary sources for carrying out R&D and also direct effort targeting related activities (production and sales, rentals and other activities).

The analysis of the main economic indicators over 2016-2018, in Romania, shows that the total revenues of the research institutes in the agricultural field sampled in our analysis, with potential impact in improving the quality and sustainability of the activity in the agricultural sector, have continuously increased from 154.484.220 RON to 184.895.489 RON, by 19,7%.On the other hand, according to EUROSTAT data for the same period, around half of the increase in income of firms operating in the bio-economy sector in the EU comes from the food and drink sector, almost one quarter of turnover is produced by the primary sectors (agriculture and forestry), while the other quarter is produced by so-called bio-based industries (such as chemicals and plastics, pharmaceuticals, paper and product industries, forest-based industries, textiles, biofuels and bioenergy). The increase in turnover was particularly visible in the food sector.

Graph 3. Structure of the economic indicators of the national R&D institutes in the agricultural area in the 2016-2018 period



Source: Ministry of public Finance - fiscal information and balance sheets (2016, 2017, 2018) https://www.mfinante.gov. ro/ pjuridice.html?

The analysis of the main indicators of research institutes sampled in this study revealed that the volume of fixed assets and equity had no direct causal relationship with either the total volume of income realized or the total amount of the excess/annual profit recorded. Thus, although they have an average annual fixed asset volume of 102.914 thousand RON, the rate of return on fixed assets has an average annual level of 0,58%, which indicates that the fixed assets are extremely limited in their operating efficiency, either because of excessive moral wear, or from a failure to attract financed activities, at the level of accessing/purchasing/employing equipment.

An even lower efficiency was recorded in terms of profitability indicators, relative to the return on capital employed, in an average annual volume of 113.944 thousand RON , which was 0,52% and the gross margin, in an average annual volume of 780 thousand RON registered an average of 3,05%, with a very modest level in relation to the added value the research field proposes to contribute to the economic area.

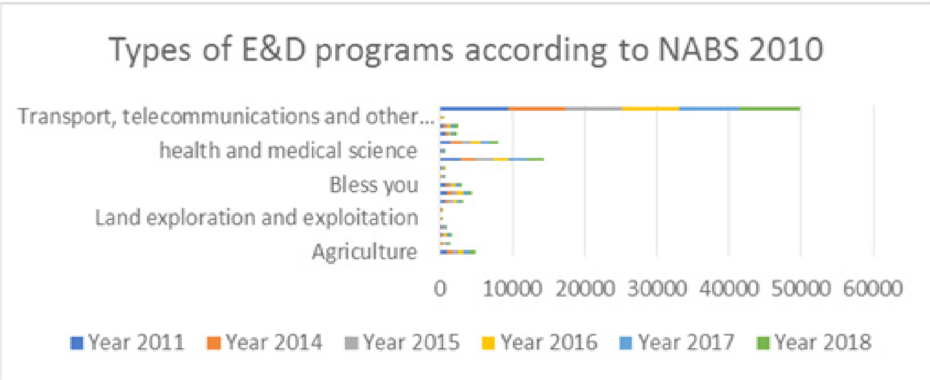
Expenditure of national research and development institutes

Table 5. Current expenditure in R&D activity by performance sectors and types of research expressed in current prices/thousand RON:

Performance sectors Thousand RON	Types of research - development	Year 2014	Year 2015	Year 2016	Year 2017	Year 2018
Government Sector Total		9.163	8.790	7.931	11.174	9.826
Public Sector	For applied research	383.014	415.433	481.901	531.286	651.610
	For experimental development	141.597	137.828	146.590	229.214	169.916
	For fundamental research	449.543	511.675	475.381	466.391	473.177

Number of projects for research activity. Number of projects and total R&D expenditure according to NABS1 by type of funding source for R&D activity in 2018.

Graph 5. Number of projects and total R&D expenditure according to NABS1.



Conclusions

The current intensity of interaction between the need of the economic sector for innovative solutions, generating results and beneficial solutions, from both an economic and environmental point of view, and also the possibility of agricultural research to provide answers to key questions in agricultural production, has failed to generate any impact or strategic synergies between market needs in the agricultural area and targeted financing interventions. The lack of a strategic coordination process, based on results and less on quantity, coupled with unimplemented management, has flawed the process of achieving remarkable results. All of this has direct effects: reducing the efficiency of spending public research funds and limiting the ability to attract private funds to contribute, alongside public funds, to financing complex direct research projects.

The structure of the revenues of the analysed national R&D institutes, reveals that of the total income from the basic activity (R&D), the share of revenue from the State budget varied in the 2016-2018 period around 95 %, in the analysis carried out at I.N.C.D.C.S.Z. Brasov - the national Research and Development Institute for sugar, potato and beet, and the situation tends to be generalized at the level of the analysed institutes. At the same time, R&D institutes have obtained revenues from other related activities, which represent 5-10% of the revenue, compared to the revenues from the core activity.

The expectations of agricultural research in Romania are linked to its potential to contribute to the eradication of "uncompetitive agriculture" and the achievement of high-performance agricultural production, ensuring the development of a sustainable, sustainable agricultural model. The programs carried out have shown that they fund agronomic research projects that are entirely geared toward intensive production. The economic system is a living, dynamic one and based on innovation. The drive for innovation is a challenge for participants across all economic areas and those who do not keep up with change risk being removed from the market, either through the un-competitiveness of the product portfolio or by the excessive production costs.

At the same time, attracted by the target of growing agricultural production, agronomists tend to promote the neoclassic type of farming, thus stimulating the most important business opportunities for the agrochemical industry. However, it uses institutional rivalries for its agenda, not without an influence, at least indirectly, on research. The analysis carried out highlights the extremely limited degree of autonomy of the agricultural science field and can be used as a basis for comparisons over a given period of time.

The challenge would then be to the extent to which it will succeed in moderating the trends of the agrochemical industry and endemic concerns of a specific work agenda in order to gain scientific capital and use it as a means of promoting the potential of research in both research institutions, On the other hand, each academic institution has a higher potential for value and resources for valuing its own assets.

Our preliminary analysis calls for the collection of the data needed for analysis to be extended, both in terms of quantitative and qualitative factors influencing its interaction and outcome, in the agricultural sector, both in the area of economic exploitation and in the area of agricultural research.

Literature

1. Achim Walter, Robert Finger, Robert Huber, and Nina Bushmann- PNAS June 13, 2017 114 (24) 6148-6150; https://doi.org/10.1073/pnas.1707462114 *Smart farming is key to developing sustainable agriculture*
2. Altieri, M., Fune-Monzette, F. and Petersen, P. (2011): *Agro-ecologycal efficient agricultural systems for smallolder farmers: Contributions to food souvereignty, Agronomy for sustainable Development,* 32(1), pp. 1–13.
3. Bud Bareth G, Aasen H, Bendig J, Soukkkamäki J (2015): *Low-weight and UA-based hyperspectral full-frame cameras for monitoring ropes: Spectral comparison with portable spectral measurement. Photogrammetrie, Fernerkundung, Geooinformation* 2015:69–79.
4. Floreano D, wood RJ (2015): *Science, technology and the future of small autonomous drones. Nature* 521:460–466..CrossReflex MedGoogle Scholar
5. Puia I., V Soran, L Carlier - 2001: *Acadenmants agri-ecology and eco-development.*
6. Kubankova, Hajek and Votava, 2016: *Enviromental and social value of Agriculture innovation.Agricultural economics*.Czech.62,pp. 101-112;
7. Levidow, L., Birch, K. and Papaioannou, T. (2012): *EU agri-innovation policy: Two counting visions of the bio-economy, critical Policy studies,* 6(1), pp. 40–65.
8. Manescu, C., & Ana Mariana Dincu , N. (2016): *Research on the evolution of the Romanian population. Research on the evolution of the Romanian population*, 159-160.
9. Mazzoleni, R., & Richard R. Nelson. (2007): *Research Policy. United States*: Department of Economics and geography, Hofstra University, Hempstead, NY 11549.
10. Pedersen, E.R., Neergaard, P., Pedersen, J.T. and Gwodz, W.(2013): *Conference and deviation: company responses to institutional reports for Corporate Social responsibility reporting*.Business Strategy and the Enviroment.22(6).pp.357-373.

11. Platelli F, Mistele B, HU Y, Chen X, Schmidhalter U (2014): *Reflection estimation of canopy nitrogen content in inter wheel using optimized hyperspectral spectral indications and partial least squeeze regression.* Euro J Agron 52:198–209..Google Scholar.
12. RAM Prasad, Atanu Bhattakaryya and Quang D. Nguyen Front. Microbiol., 20 June 2017 https://doi.org/10.3389/ fmicb. 2017. 01014 *Nanotechnology in sustainable Agriculture: Recent developments, challenges, and Perspectives.*
13. Smita Martijn J., (2015): Eveline S. van Leeuwen, Raymond J.G.M. Florax, Henri L.F. de Groot, *Rural development funding and agricultural labor productivity: A spatial analysis of the European Union* NUTS2 level, ecological indicators 59, 6–18.
14. The Wahabzada M, et al. (2016): *Plant phenotyping using probabilistic topic models: Uncoverage the hyperspectral language of plantations*. SCI Repp 6:22482.
15. Wisner, P.S., Epstein, M.J. and Bagozzi, R.P.(2010): *Enviromental Proactivity and performance. Sustainability, environmental performance and discoveries.*

SUSTAINABLE DEVELOPMENT PRINCIPLE IN THE FIELD OF ENVIRONMENTAL PROTECTION

Milan Počuča[1], *Jelena Matijašević*[2]

Abstract

The preservation and protection of the environment represents an imperative in modern society. The environment is an integral part of the concept of sustainable development, which, among other things, means that this concept is based on the balance between the social, economic and environmental aspects of the development of society. Therefore, sustainable development as a concept refers to the equality of environmental protection as one of the goals, in relation to economic and social development. After a brief introductory observation on the essential aspects of sustainable development as a concept, the paper discusses in more detail the conceptual definitions and principles of sustainable development management and the sustainable development principle as one of the essential principles of environmental protection.

Key words: *sustainable development, environmental protection, economic efficiency, social responsibility.*

Introduction

In recent decades society has, among other things, been characterized by a devotion to the sustainable development concept[3] as a contemporary multidisciplinary development concept[4], which is, as explained above, based on economic, cultural and ecological development. Even though multidisciplinary, and consequently

1 Milan Počuča, Ph.D., Full Professor, Faculty of Law for Commerce and Judiciary in Novi Sad, Geri Karolja no. 1, 21000 Novi Sad, Serbia, Phone: +381 63 224 740, E-mail: pocucabmilan@gmail.com

2 Jelena Matijašević, Ph.D., Associate Professor, Faculty of Law for Commerce and Judiciary in Novi Sad, Geri Karolja no. 1, 21000 Novi Sad, Serbia, Phone: +381 61 653 87 47, E-mail: jelena@pravni-fakultet.info

3 Šimkova Eva (2007): *Strategic approaches to rural tourism and sustainable development of rural areas*, Agricultural Economics, Czech Academy of Agricultural Sciences, Czech Republic, 53 (6), 263–270, p.236.

4 Matijašević-Obradović Jelena, Škorić Sanja (2017): Elementary Strategic and Legislative Treatment of Rural Development Policy, Sustainable Agriculture and Rural Development in terms of the Republic of Serbia strategic goals realization within the Danube Region - Support programs for the improvement of Agricultural and Rural Development, Institute of Agricultural Economics, Belgrade, The Republic of Serbia, 14-15th December 2017, 282-299, p. 283.

universality, is one of the basic elements of the sustainable development concept, Arbuthnott states that although a large number of countries define sustainable development in different ways, one of the most common focuses is actually on the preservation of the natural environment.[5] According to Pokrajac, sustainable development is a synthesis of the essential principles of economics and ecology, which are important for the overall social development.[6]

As Filipović points out, "the ecological dimension is concerned with the preservation of biodiversity, conservation and rational use of natural resources, reduction of environmental pollution, care of endangered species, their habitats, ecosystems, etc.",[7] so that there are several areas "based on which we can observe the ecological dimension of sustainable development: the atmosphere, soil, oceans, seas, waters and biodiversity".[8]

The National Sustainable Development Strategy, which was in use until three years ago, defines sustainable development as "a goal-oriented, long-term, continuous, all-embracing, and synergetic process which affects all aspects of life (the economic, social, ecological and institutional) at all levels. At the same time, sustainable development includes the design of models which, in a high-quality way, satisfy the socio-economic needs and interests of citizens, while eliminating, or significantly reducing, any influences threatening or damaging the environment and natural resources."[9] The long-term sustainable development concept, according to the Strategy referred to above, assumes "constant economic growth which, besides economic efficiency, technological progress, more cleaner technologies, innovativeness of the whole society and socially responsible business dealing, ensures a reduction of poverty, a better long-term use of resources, an improvement of health conditions and the quality of life, and a pollution reduction to a level bearable to environment factors, the prevention of new pollutions and biodiversity preservation. One of the principal aims of sustainable development is the creation of new jobs and a reduction of the unemployment rate, as well as a reduction of gender

---

5 Arbuthnott D. Kathetine (2009): *Education for sustainable development beyond attitude change*, International Journal of Sustainability in Higher Education, 10 (2), 152-163.

6 Pokrajac Slobodan (2009): *Održivi razvoj i ekološka ekonomija kao poslovne paradigme*, Škola biznisa, Visoka poslovna škola strukovnih studija, Novi Sad, Srbija, 4, 21-30, p. 24.

7 Filipović Marina (2019): Konceptualizacija održivog razvoja i ekološko obrazovanje, Vojno delo, Ministartvo odbrane, Beograd, 2, 55-68, p. 61.

8 Miltojević Vesna (2011): *Kultura kao dimenzija održivog razvoja*. Teme, Univerzitet u Nišu. NIš, 35(2), 639-653.

9 Nacionalna strategija održivog razvoja za period 2008-2017. god, Sl. Gl. RS, br. 57/2008.

and social inequality of marginalized groups, encouragement of employment of young people and the disabled, as well as other high-risk groups."[10]

In addition to the aforesaid, as Miljanović points out, it is very important "to accept the fact that sustainability is a multi-layered phenomenon and that the sustainable development paradigm has the greatest potential as a new critical awareness of the limitations of the existing development models, and as a point of reference, with its specific goals and criteria".[11] In this context, Matijašević-Obradović and Kovačević state that the versatility of sustainable development is the foundation of the European development framework.[12]

In keeping with the aforesaid, the Strategy of Sustainable Urban Development of the Republic of Serbia to 2030 was adopted in 2019, according to which "national governments formulate the national strategic framework for the policy of urban and spatial development which promotes sustainable urbanization models, including a corresponding standard of living for the present and future inhabitants, economic growth and environmental protection, a balanced system of cities and other settlements, and clearly defined rights and obligations relating to land for all citizens, also including the security of abode for the poor, as a starting point for urban and spatial planning at all levels. In return, urban and spatial planning will be a means of translating that policy into plans and activities, as well as of providing feedback with the aim of its adjustment".[13]

Following this brief introductory observation on the essential aspects of sustainable development, the paper will discuss in more detail the conceptual definitions and principles of sustainable development management, and the sustainable development principle as one of the basic principles of environmental protection.

---

10 Ibid.

11 Miljanović Dragana (2006): *Neka pitanja integrisanja ekološke problematike u strategije održivog razvoja*, Bulletin of the Serbian Geographical Society, Serbian Geographical Society, The Republic of Serbia, 86 (2), 207-222, p. 207.

12 Matijašević-Obradović Jelena, Kovačević Maja (2016): The importance of the ICT for the purpose of increasing Competitiveness of Rural Areas, Sustainable Agriculture and Rural Development in terms of the Republic of Serbia Strategic goals realization within the Danube Region - Development and Application of Clean Technologies in Agriculture (eds Jonel Subić, Boris Kuzman, Andrei Jean Vasile), Institute of Agricultural Economics, Belgrade, The Republic of Serbia, 15-16th December 2016, 492-509, p. 493.

13 Strategija održivog urbanog razvoja Republike Srbije do 2030. godine, Službeni glasnik RS, br. 47/2019.

The sustainable development concept and management principles

We have said in the introduction that sustainable development, as a multidimensional or universal concept, incorporates three aspects: ecological sustainability, economic efficiency and social responsibility. This sustainable development concept is also known as a "three-pillar model", or a "three-circle model".[14] In addition, all the three factors are interconnected, so that none of them is sufficient in itself.

When conceptually defining sustainable development, some authors state that sustainable development, along with the protection and conservation of natural resources, enables significant material progress[15], while some authors prefer sustainable economic growth.[16] The International Institute for Sustainable Development on the other hand points out that "the basis of the sustainable development concept lies in the idea that ingragenerational and intergenerational equality influences the shaping or changes of national economics and global development".[17]

Respecting the sustainable development management principles, Đekić and Hafner point out that "sustainable development requires an integration of ecological, social and economic goals within the decision-making and implementation process. This implies a horizontal and vertical integration of different management levels and their aspiration towards accomplishing a shared goal. The balancing, or equal recognition of all the three dimensions of sustainable development in the decision-making process is very difficult. As a result, efficient management of sustainable development requires multilinear management of the distribution of responsibilities and authorities involved in the decision-making process on different levels."[18]

---

14 Giddings Bob, Hopwood Bill, O'Brien Geoff (2002): *Environment, Economy and Society: Fitting the Together into Sustainable Development*, Sustainable Development, Sustainable Cities Research Institute, Newcastle upon Tyne, UK, 10, 187−196, p. 189.

15 Pravdić Velimir (2001): *Sustainability and Sustainable Development: the Use in Policies and the Ongoing Debate on These Terms*, Croatian International Relations Review, Republika Hrvatska, 7, str. 93-100.

16 Borozan Đula (2006): *Makroekonomija*, Ekonomski fakultet u Osijeku, R. Hrvatska.

17 Đekić Snežana, Hafner Nenad (2013): *Savremeni koncept upravljanja institucionalnom dimenzijom održivog razvoja*, Teme, Univerzitet u Nišu, Republika Srbija, 37 (3), 1243-1261, str. 1244.

18 Đekić Snežana, Hafner Nenad (2013), op. cit., str. 1248-1249.

The sustainable development principle as one of the basic principles of environmental protection

According to article 9, point 4 of the Law on Environmental Protection, "sustainable development is a harmonized system of technical-technological, economic and social activities within the total development in which the natural and manmade assets of the Republic of Serbia are used following the principles of thrift and rationality with the aim of preserving and improving the quality of the environment for the present and future generations. Sustainable development is realized by making and implementing decisions which provide a harmonization of environmental protection interests with those of economic development".[19]

The environment consists of all elements of human life and production activity.[20] Accordingly, everyone has the right to a healthy environment.

The preservation and protection of the environment represents an imperative in contemporary society. The environment is an important element of the concept of sustainable development, which equally respects the three basic categories of modern development - social, economic and environmental.

The World Health Organization identifies five essential ecological requirements for a healthy environment: clean air, sufficient quantities of safe drinking water, safe and well-balanced nutrition, safe and quiet settlements and stable ecosystems in which humans lead high-quality lives.[21]

According to article 11 of the Law on Environmental Protection, "the management of natural assets is realized through the planning of their sustainable use and the preservation of their quality and diversity. In that regard, natural assets include: 1) natural resources as renewable or non-renewable geological, hydrological and biological assets which may be, directly or indirectly, used or exploited, and which have a real or potential economic value; 2) protected natural assets; and 3) public natural assets".

According to article 21, the protection of natural assets is realized by implementing measures aimed at preserving their quality, quantities and reserves, as well as the natural processes, or their interdependence and an overall natural equilibrium.

19 Zakon o zaštiti životne sredine, Službeni glasnik RS, br. 135/2004, 36/2009, 36/2009 - dr. zakon, 72/2009 - dr. zakon, 43/2011 - odluka US, 14/2016, 76/2018, 95/2018 - dr. zakon i 95/2018 - dr. zakon.

20 Hamidović Dženana (2012): *Krivičnopravna zaštita* životne *sredine i održivi razvoj naše zemlje*, Socioeconomica, Akroasis, Novi Pazar, 1 (2), 235-245, str. 235-236.

21 Krvavac Ljubinka, Jovanetić Vesna (2010): *Vodič kroz zaštitu i unapređivanje* životne *sredine*, Užički centar za prava deteta, Užice, str. 14.

Conclusion

The primary goal of sustainable development is the optimized use of natural resources. From this setting, it can be concluded that sustainable development implies equal development of three key components of modern development - economic, social and environmental. Thus the ecological dimension is very significant, the management of natural resources being the foundation of the overall social development. The paper also points to the fact that sustainable development as a multidimensional or universal concept incorporates three aspects: ecological sustainability, economic efficiency and social responsibility.

After a brief introductory observation of sustainable development as a concept, the paper included an analysis of the concepts and principles of sustainable development management, and the principles of sustainable development as one of the basic principles of environmental protection.

Literature

1. Arbuthnott D. Kathetine (2009): *Education for sustainable development beyond attitude change*, International Journal of Sustainability in Higher Education, 10 (2), 152-163.
2. Borozan Đula (2006): *Makroekonomija*, Ekonomski fakultet u Osijeku, Osijek, Republika Hrvatska.
3. Đekić Snežana, Hafner Nenad (2013): *Savremeni koncept upravljanja institucionalnom dimenzijom održivog razvoja*, Teme, Univerzitet u Nišu, Republika Srbija, 37 (3), 1243-1261
4. Filipović Marina (2019): Konceptualizacija održivog razvoja i ekološko obrazovanje, Vojno delo, Ministartvo odbrane, Beograd, 2, 55-68.
5. Giddings Bob, Hopwood Bill, O'Brien Geoff (2002): *Environment, Economy and Society: Fitting the Together into Sustainable Development*, Sustainable Development, Sustainable Cities Research Institute, Newcastle upon Tyne, UK, 10, 187−196.
6. Hamidović Dženana (2012): *Krivičnopravna zaštita* životne *sredine i održivi razvoj naše zemlje*, Socioeconomica, Akroasis, Novi Pazar, 1 (2), 235-245.
7. Krvavac Ljubinka, Jovanetić Vesna (2010): *Vodič kroz zaštitu i unapređivanje životne sredine*, Užički centar za prava deteta, Užice.

8. Matijašević-Obradović Jelena, Kovačević Maja (2016): The importance of the ICT for the purpose of increasing Competitiveness of Rural Areas, Sustainable Agriculture and Rural Development in terms of the Republic of Serbia Strategic goals realization within the Danube Region - Development and Application of Clean Technologies in Agriculture (eds Jonel Subić, Boris Kuzman, Andrei Jean Vasile), Institute of Agricultural Economics, Belgrade, The Republic of Serbia, 15-16th December 2016, 492-509.
9. Matijašević-Obradović Jelena, Škorić Sanja (2017): Elementary Strategic and Legislative Treatment of Rural Development Policy, Sustainable Agriculture and Rural Development in terms of the Republic of Serbia strategic goals realization within the Danube Region - Support programs for the improvement of Agricultural and Rural Development (eds Jonel Subić, Boris Kuzman, Andrei Jean Vasile), Institute of Agricultural Economics, Belgrade, The Republic of Serbia, 14-15th December 2017, 282-299.
10. Miltojević Vesna (2011): *Kultura kao dimenzija održivog razvoja*. Teme, Univerzitet u Nišu. NIš, 35(2), 639-653.
11. Miljanović Dragana (2006): *Neka pitanja integrisanja ekološke problematike u strategije održivog razvoja*, Bulletin of the Serbian Geographical Society, Serbian Geographical Society, The Republic of Serbia, 86 (2), 207-222.
12. Nacionalna strategija održivog razvoja za period 2008-2017. godine, Službeni glasnik RS, br. 57/2008.
13. Pokrajac Slobodan (2009): *Održivi razvoj i ekološka ekonomija kao poslovne paradigme*, Škola biznisa, Visoka poslovna škola strukovnih studija, Novi Sad, Republika Srbija, 4, 21-30.
14. Pravdić Velimir (2001): *Sustainability and Sustainable Development: the Use in Policies and the Ongoing Debate on These Terms*, Croatian International Relations Review, Republika Hrvatska, 7, str. 93-100.
15. Pokrajac Slobodan (2009): *Održivi razvoj i ekološka ekonomija kao poslovne paradigme*, Škola biznisa, Visoka poslovna škola strukovnih studija, Novi Sad, Republika Srbija, 4, 21-30.
16. Strategija održivog urbanog razvoja Republike Srbije do 2030. godine, Službeni glasnik RS, br. 47/2019.

17. Šimkova Eva (2007): *Strategic approaches to rural tourism and sustainable development of rural areas*, Agricultural Economics, Czech Academy of Agricultural Sciences, Czech Republic, 53 (6), 263–270.
18. Zakon o zaštiti životne sredine, Službeni glasnik RS, br. 135/2004, 36/2009, 36/2009 - dr. zakon, 72/2009 - dr. zakon, 43/2011 - odluka US, 14/2016, 76/2018, 95/2018 - dr. zakon i 95/2018 - dr. zakon.

POSSIBILITY OF ORGANIC PRODUCTION IN GOATRY

Milivoje Urošević[1], *Radomir Mandić*[2], *Natalija Gritner*[3]

Abstract

Organic goat production in Serbia is promising, considering that the number of heads is around 200,000. The principles of organic production in goat breeding should be applied in the following conditions: choice of head, procurement of kids, meat production, food, replacement, treatment, prevention, illness, therapy, medicines, records, reproduction, castration, binding, transport, accommodation, movement, floor, fertilization, manure, marking, surface, hoofs. Since organic production is expensive, state support is needed.

Key words: *organic goat production, Serbia, principles of organic production, state support.*

Introduction

After decades of efforts for faster, more extensive and, of course, more profitable production, in all areas, including livestock, there was a significant saturation and visible sobriety. The journey has led to oversaturation of the market and the offer of products which, with their content, become dangerous to human health. Significant problems have arisen because of the enormous increase in the amount, most often uncontrolled processes, of funds in the field of pharmacology, plant protection, hormonal preparations, all with the aim of achieving higher yields as quickly as possible. There is a desire and need for production that will not be burdened by these problems, and to meet the growing needs in food as the population is constantly increasing. Predictions say that the population of people will number 9 billion in 2050. It needs to be fed.

Now there is a certain contradiction. An increasing number of consumers demand more and more products, and on the other hand, such intensive production requires hybrids that can make such demands and apply intensive agrotechnical measures. Despite the high productivity of hybrids, this type of production

1 Milivoje Urošević, Ph.D., COAR - Center for the Preservation of Indigenous Races, Vere Dimitrijević no. 9, 11080 Zemun, Serbia, Phone: +381 63 88 298 99, E-mail: m.urosevic@gmail.com

2 Radomir Mandić, Ph.D., Assistant Professor, Faculty of Applied Ecology "Futura", Bulevar Vojvode Misica no. 37, 11000 Belgrade, Serbia, Phone: +381 63 651 315, E-mail: radomir.mandic@futura.edu.rs

3 Natalija Gritner, M.Sc., Faculty of Applied Ecology "Futura", Bulevar Vojvode Misica no. 37, 11000 Belgrade, Serbia, Phone: +491 577 129 23 51, E-mail: natalija.grittner@gmail.com

quickly leads to a significant neglect of primitive, indigenous breeds in production. Their productivity is at a significantly lower level, but the products, meat, milk, eggs, have several advantages, in terms of quality compared to those from intensive production The main problem is to find a balance between growing needs and the desire to produce environmentally friendly products.

Intensive production has led to significant changes in biodiversity, primarily genetic. Therefore, there is an urgent need for conservation and preservation of genetic biodiversity. It was concluded that such measures also preserve the national identities of the peoples, since autochthonous races are proof of their existence in certain areas.

Material and methods

The paper points out the need for organic production as the best way to preserve indigenous genetic resources. The volume of organic production in some European countries is presented, and an example of organic livestock production in neighboring Croatia is given.

The paper lists the conditions (23) that must be met in order to achieve organic goat breeding, ie breeding in the „Bio system“.

Results and discussion

Preservation and protection of genetic diversity is an advantage and a huge biological capital. The importance of that and the need for conservation is defined at the international level, primarily by the Convention on Biodiversity, adopted back in 1992. in Rio de Janeiro, as well as the Cartagena Protocol (SCBO, 2000) (Ružica Trailović, Vera Savić 2019).

The solution to this problem, or an attempt to solve the problem, was found in organic farming and organic livestock. According to Mitrović and Vera Đekić (2013), organic production is based on the basics of agroecology.

In order to obtain a product of other biological properties, in relation to those obtained in the process of intensive agricultural livestock production, it is necessary to establish a complete system, and it starts with the ecological cultivation of agricultural land. In that system, Liechtenstein is in the first place, where 17% of the area is under the ecological regime of production. In second place is Austria with 11.3% of ecological areas, followed by Switzerland with 9.3%, Sweden with 9% (IFOAM 2003, cit. Šimpraga 2013). Organic production on farms is the most massive in Italy. In our immediate environment, Croatia pays significant attention to the ecological method of production.

Table 1. Number of animals in organic farming in Croatia from 2005 to 2011 (HPA, cit. Šimpraga 2013)

Species	**2005.**	**2006.**	**2007.**	**2008.**	**2009.**	**2010.**	**2011.**
Cattle	315	345	2.749	5.813	6.144	9.796	7.646
Hoofed animals	45	19	134	417	484	452	920
Sheep	4.520	3.952	6.326	10.501	9.688	9.349	14.773
Goats	2.226	1.938	3.517	2.780	1.492	1.545	1.206
Pigs	181	184	473	336	1.299	130	448
Poultry	5.717	1.180	2.885	3.597	1.612	1.137	2.107
Bees (hives)	671	822	2.710	2.780	2.121	2.381	1.804
Rabbits	-	11	81	-	50	50	-
Shellfish (t)	-	-	30	20	-	5	-

While in Serbia such programs are quite difficult to put into practice and even more difficult to implement, in neighboring Romania, a book on management on organic farms was published in 1998 (Gruia 1998).

The World Food Organization (FAO) has defined organic production as a continuous process of sustainable rural development in accordance with the available resources, biodegradable potentials of the present population, respecting traditional production flows (www.fao.org).

The need for organic production is increasing every day. The International Federation of Organic Agriculture Movements (IFOM) was founded in 1972.

In order to start and later organize such production, it is necessary to fulfill certain conditions, and that the foreseen conditions are fulfilled and that the production takes place according to the demanding principles of biological production, confirmed by appropriate, accredited institutions.

World Food Organization (FAO). gave in 1990 official support to this way of production. As early as 1998, there were 2.3 million hectares in 15 European countries that were cultivated according to the principles of organic production (Šimpraga, 2013). The areas increased so that in 2000, Europe had 3.8 million ecological hectares. Leading countries in organic production are England, Germany, Austria, Italy, Norway, Sweden, Denmark. The most organic farms in the world are in the Austrian province of Salzburg, where every other farm is engaged in organic production.

In recent years, there has been more and more talk about the need to change the way in which goats are raised and to introduce the „Bio“ system, ie biologically pure breeding. This method of production gives products that are free of chemical elements that are integral parts of many preparations used in conventional production (Urošević et al., 2020). That is why this method of production is called biological, since there is no use of chemical preparations in the growth and protection of plants, hormonal and other stimulating preparations for growth and development. Individuals grow and develop according to their natural potential and achieve production according to their natural characteristics.

According to the data of the Republic Bureau of Statistics (Stat. 2020, p. 221) in Serbia, the number of goats in the previous three years looked like this:

- 2017 - 183,000 head
- 2018 - 196,000 head
- 2019 - 191,000 heads,

which indicates the great potential and possibilities to grow a part of the throat in the “Bio system”.

Those who are interested in engaging in production in the “Bio System” must meet certain conditions, and basically, they are:

1. Choice of head - for this production, milk or meat, it is necessary to choose a breed of goat or type. Selected individuals must have a good ability to adapt to local conditions. It is necessary that they are vital, resistant to diseases. When it comes to the choice of breed, it is recommended to choose local breeds, ie breeds adapted to the existing climatic conditions.

2. Procurement of kids - if for the needs of biological production kids are bought from commercial breeding, they must not be older than 45 days. In order to enable the overhaul of the herd, it is necessary to buy up to 20% of female kids.

3. Meat production - in case the farm is oriented towards meat production, feeding methods are applied, which can always be changed. It is necessary to keep in mind that forced feeding is forbidden. In such traps, the kid, after birth, must receive natural milk for at least 45 days. Breast milk is preferred. Therefore, there is no use of artificial milk substitutes.

4. Food - from the total amount of daily food, at least 60% must be voluminous nutrients, fresh, dried or ensiled. In dairy goats, only after 3 months of lactation is it possible to reduce the amount of voluminous food to 50%.

5. Replacement - if due to bad weather conditions it is not possible to provide enough amounts of organic food for feeding goats, it can use conventional food in the amount of a maximum of 10%.

6. Treatment - veterinary procedures, treatment and prevention of diseases belong to the group of the most sensitive aspects of biological goat breeding.

7. Prevention - in organic farming, the emphasis must be on preventing diseases and preventing their eventual occurrence. Preventive protection procedures must be carried out from the moment of selection of breed, individual heads as well as selection of technological procedures. In order to enable adequate resistance of individuals, it is necessary to provide quality food, enough movement and appropriate number of heads per unit area.

8. Sore throat - if the disease occurs, the throat must be helped immediately, and if necessary, it must be isolated.

9. Therapy - in case of necessary therapy, preference should be given to herbal therapy (phytotherapy), homeopathy, application of mineral preparations. If the use of these preparations does not give the expected results, then the use of antibiotics and other chemical agents may be allowed. All this must be under the strict control of a veterinarian.

10. Medicines - in the process of biological production, the use of medicines for preventive purposes is not allowed. The use of agents that stimulate growth and production, including antibiotics and coccidiostats, is prohibited. In addition, the use of means for synchronization and stimulation of sexual heat is prohibited. The use of hormones can be approved only for therapeutic purposes and individually.

11. Records - it is necessary that there is a complete record of the use and application of all means.

12. Reproduction - the process of reproduction must take place in a natural way. Artificial insemination is allowed, but other forms of treatment, as well as embryo transfer, are prohibited.

13. Castration - the process of castration as well as decornuation is allowed only in individual cases, and not as a systemic solution. When performing these procedures, conditions must be provided to minimize pain.

14. Tying (binding) - in case certain technological operations require tying animals, it is allowed only for a limited time.

15. Transport - loading, unloading and transport of animals must be organized so that stress is minimized. The use of electrical aids such as electric heaters and the like is prohibited.

16. Accommodation - a goat accommodation stable must meet the microclimatic and spatial limits for each head category. Animals must be housed in clean areas free from rodents and insects. Their suppression can be organized by applying the allowed means.

Figure 1. Large adhesive board for catching insects on farms for bio-milk production (Photo: M. Urošević).

Source**:** Photo, M. Urošević

17. Movement - animals must be able to move freely throughout the year, regardless of the weather.

Figure 2. Access to the grazing is possible at any time.

Source: Photo, M. Urošević

The grazing should have a covered part that provides protection from bad weather as well as during the summer period.

18. Floor - in the barn the floor must be flat, not slippery. The floor area can be a maximum of 50% lattice. It is necessary to provide enough lying areas. The mat used must be made of natural materials, and certain mineral substances may be added.

19. Fertilization - when cleaning the facility, the manure must be taken out of the barn at the same time. It is allowed to take out the manure once during the year, ie it must be taken out when it is accumulated so that it represents the equivalent of 170 kg of nitrogen per hectare. In practice, this means the amount of garbage produced by 13.3 goats in a year (Milena Fantova et al. 2015)

20. Landfill - the landfill must be large enough to allow manure to be stored for 6 months.

21. Marking - each head must be marked with ear tags, and for each head there must be complete documentation which includes: origin, date of arrival on the farm, and if it originates from own production, date of kidding. There must be an accurate record of all measures and interventions taken.

22. Area - 1 m^2 must be provided for each adult goat, and if it is a mother with a kid, then that area is 2 m^2.

23. Hoofs - hoofs must be inspected at least twice a year and measures taken to shorten and nurture them.

It must be borne in mind that this production is expensive so that it can hardly be successfully organized without state support. That support should not be shorter than 10 years. (Šimpraga 2013). Then such producers cannot be independent suppliers on the market, but they should have an organized economic entity that would organize a good part of technical, administrative, and especially sales activities for them. Cooperatives must be organized.

Conclusion

The way to preserve genetic resources is organic production, i.e. cultivation in the "Bio system" when it is about animal genetic resources.

Serbia has significant potential in the number of goats currently being bred. For their translation into the "Bio system" of cultivation, the principles of organic production must be respected, i.e. certain conditions must be met.

For successful breeding of goats in organic production, especially in the initial period, financial help and support from the state is needed, since this production is demanding.

Literature

1. Fantova Milena a kol., (2015): *Choc koz*. Brazda, Praha
2. Mitrović Sreten, Đekić Vera, (2013): *Organska* živinarska *proizvodnja*. Poljoprivredni fakultet, Beograd-Zemun.
3. *Organic agriculture and sustainable agriculture and rural development*, www.fao.org , (10.11.2020.).
4. Romulus Gruia, (1998). *Managementul eco-farmelor*. Editura Ceres, Bucuresti.
5. Republički zavod za statistiku Srbije, (2020) (pp 445). *Statistički godišnjak Srbije*, Beograd.
6. Trailović Ružica, Savić Mila, (2019): *Perspektiva održivog uzgoja autohtonih rasa domaćih* životinja *u Srbiji*. Zbornik radova, Simpozijum "Zaštita agrobiodiverziteta i očuvanje autohtonih rasa domaćih životinja". Dimitrovgrad. str.24-34
7. Urošević Milivoje, Drobnjak Darko, Ersoy Nilda, Stojić Petar (2020): *Osnovni principi organske proizvodnje u kozarstvu*. Veterinarska stanica 51 (1), 87-91.
8. Šimpraga Miljenko, (2013): *Ekološko ovčarstvo i kozarstvo na krškim područjima Republike Hrvatske*. Sveučilište u Zagrebu, Veterinarski fakultet, Zagreb.

SELECTION OF APPLE HARVESTING MACHINE BY THE USE OF FUZZY METHOD OF MULTI-CRITERIA ANALYSIS

Miroslav Nedeljković[1], Adis Puška[2], Milorad Đokić[3], Velibor Potrebić[4]

Abstract

Rapid development of agricultural production has imposed the need for use of modern machines for the realization of required production operations. In line with that, according to the multi-criteria decision-making, i.e., by the use of CRITIC method and MARCOS fuzzy method, the selection of a machine for apple harvesting (apple tree shaking) was performed. Gained results show that selection among three alternatives, i.e. manual apple tree shaker with hydraulic or pneumatic drive, tractor carried (hydraulic) apple tree shaker, apple tree shaker on a towed machine, proved the second alternative to be the best. The choice among the offered options was made based on seven predefined criteria set by the experts from the researched subject area. The importance of research is found in adequate application of the multi-criteria analysis methods, especially fuzzy methodology, in the process of selecting the most suitable option in apple harvesting machines (apple tree shakers).

Key words: *apple harvesting, multi-criterion decision making, method CRITIC, method MARCOS, fuzzy logic.*

Introduction

Along with the growth of the global population, and the rise of demand for food products, traditionally used agricultural mechanization have been more and more replaced by the modern mechanical and technological procedures, certainly including the harvesting (considering tree shaking) of fruits. Previously mentioned are confronting the agricultural producers with the special challenge, especially

1 Miroslav Nedeljković, Ph.D., Assistant Professor, Bijeljina University, Faculty of Agriculture, Pavlovica put bb, Bijeljina, Republic of Srpska, Bosnia and Herzegovina, Phone: +387 66 893 935, E-mail: miroslavnedeljkovic2015@gmail.com

2 Adis Puška, Ph.D., Institute for Scientific Research and Development, Adila ef. Čokića no. 32, 76100 Brcko District, Bosnia and Herzegovina, Phone: +387 61 305 535, E-mail: adispuska@yahoo.com

3 Milorad Đokić, Ph.D., Assistant Professor, Bijeljina University, Faculty of Agriculture, Pavlovica put bb, Bijeljina, Republic of Srpska, Bosnia and Herzegovina, Phone: +381 65 685 93 37, E-mail: milorad59@yahoo.com

4 Velibor Potrebić, M.A., Institute of Agricultural Economics, Volgina no. 15, 11060 Belgrade, Serbia, Phone: +381 11 6972 852, E-mail: velibor_p@iep.bg.ac.rs

in decision making situations towards the proper selection of modern agricultural machines. Such an example is harvesting (apple tree shaking) of apple fruits.

The apple appertains to the group of roses, while this is the fruit that is globally produced the most. Currently, it is grown in many countries, mostly in north hemisphere, while commercial production covers around couple hundred varieties (Ivanović, Jeločnik, 2009). High adaptability of the plant, as well as expressed quality of its fruits has been ensured the apples good ranking among globally produced fruit species (Užar et al., 2019). From the aspect of technology, apples production requires complex approach. It involves quite a lot of labour and other inputs (mostly agri-chemicals), initiating the significant investments. At same time, apple production represents greatly accumulative line in fruit sector (Nedeljković, Potrebić, 2020). Besides, as a fruit species, apples have highly pronounced healthy and medicinal features, while they are used as fresh or processed agri-food product (Jeločnik et al., 2019).

Decision-making in agriculture is a complex activity. Due to the impossibility of quantification decisions are usually made according to available qualitative data, or even more often combining with existing quantitative data (Blagojević, et al., 2017). For this reason, in recent years multi-criteria analysis has found great application in sector of agriculture, especially in fruits and grape production (Draginčić et al., 2015; Milovanović, Stojanović, 2016; Rozman et al., 2017; Maksimović et al., 2017; Paunović et al., 2018; Maksimović et al., 2018). Besides, application of multi-criteria decision-making with its associated fuzzy methods has been already done in selection of different types of basic or specific machines in agriculture. This is confirmed by several scientific papers prepared by foreign authors in last decade (Sahu et al., 2015; Khandekar, Chakraborty, 2015; Turskis et al., 2015; Wu et al., 2016).

Main goal of paper is to conduct, according to multi-criteria decision-making, the selection of appropriate machine for apple harvesting (apple tree shaking).

Used Methodology

Decision making what is the best fruit harvesting machine (fruit tree shaker) is based on the CRITIC (*CRiteria Importance Through Inter-criteria Correlation*) and fuzzy MARCOS (*Measurement Alternatives and Ranking according to COmpromise Solution*) methods. The research methodology was based on previously created questionnaire that was sent to certain number of experts from the observed field of science/economy to give the adequate answers. The survey was conducted during the October 2020. In order to avoid the subjectivity in determination of the criteria's weights, the CRITIC method was used.

After the weights of the criteria were determined, the all alternatives were ranked by the use of the fuzzy MARCOS method. All steps considered in implementing the CRITIC and fuzzy MARCOS methods will be later presented in detail. At the end, a sensitivity analysis was performed in order to examine how certain criteria are affecting the alternatives' ranking. Definition of research problem and goal are marked as initial step in any research. The main issue in this research is to find the best alternative for the fruit harvesting (by the method of tree shaking), as well as to find what alternative achieves the best results, while it minimally affects the fruit tree. During the fruit tree shaking, it is required to harvest all fruits but without damaging the trunk and branches. According the previously defined research problem, it was determined the main goal of research, i.e. the enabling the decision making and selection of the best possible alternatives (the alternative that optimally solves the research problem) based on application of different combinations of multi-criteria analysis methods (MCDA). In line to research problem and goal, it was defined the proper direction of research.

In order to evaluate fruit harvesting alternatives (based on tree shaking), the collection of adequate data is previously required. Due to the specificity of the research problem, expert decision-making was used. Therefore, the next step in offered methodology was the experts' selection. Researchers from the Faculty of Agriculture in Belgrade and Novi Sad are served as experts. Research considers ratings collected from the four experts. All experts are involved in fruit production for many years.

Before all, with experts were conducted the selection of criteria that will be used for evaluation of the fruit harvesting machines (based on tree shaking). Selected criteria are:

C1 – *Costs of utilisation*,

C2 – *Vibration*,

C3 – *Efficiency of usage*,

C4 - *Convenience of handling*,

C5 – *Possibilities of malfunction/Period of usage*,

C6 – *Possibility for automatization of activity,*

C7 – *Working capacity of the machine,*

C8 – *Ergonomics*,

C9 – *Safety at work.*

Since there are differences in nature of chosen criteria, it is important that experts' mark/rating of some of them have to be as higher as possible (these are so-called benefit criteria), while for others expert's mark/rating has to be as lower as possible (these are so-called cost criteria). Thus, criteria C3, C4, C6, C7 and C8 are representing benefit criteria, so for the potential alternative is better that these criteria have the maximally possible mark/rating, while for criteria C1, C2, C5 and C9 it is better that make/rating is at the much possible lower level.

After that, together with experts all alternatives that will be evaluated were defined. Selected alternatives are: A1 – manual apple tree shaker with hydraulic or pneumatic drive, A2 - by tractor carried (hydraulic) apple tree shaker, and A3 – apple tree shaker on a towed machine. According to previously defined criteria and alternatives, the proper questionnaire was created. Expert's responsibilities were only to give the marks/ratings for the selected alternatives by the use of previously defined criteria. For that purpose they were used previously determined scale of attributive values, as well as seven degrees scale in which the marks/ratings have been ranged from very poor to very good (Table 1.).

CRITIC method

CRITIC method has been established by Diakoulaki et al. (1995). Method is used to define the objective values of the criterions' weight, including the intensity of contrast and conflict contained within the structure of the decision-making issue (Puška et al., 2018). For determination contrasts of criteria, the standard deviations of the normalized values of the variants per columns are used, as well as the correlation coefficients of all columns' pairs. Steps used during the realisation of CRITIC method are:

Step 1. Deffuzification of initial matrix of decision making. Before the other steps of the CRITIC method are conducted, the fuzzy numbers have to be transferred into the numeric values (Table 1.).

Table 1. Membership function of fuzzy numbers for criterions weighting and alternatives assessment.

Linguistic values	Fuzzy numbers
Very bad (VB)	(0,0,1)
Bad (B)	(0,1,3)
Medium bad (MB)	(1,3,5)
Medium (M)	(3,5,7)
Medium good (MG)	(5,7,9)
Good (G)	(7,9,10)
Very Good (VG)	(9,10,10)

Source: Kiani Mavi et al., 2016; Mijajlović et al. 2020.

Deffuzification is done based on following mathematic formula:

$$P(\tilde{m}) = \frac{1}{6}(m_1 + 4m_2 + m_3)$$

Where:

m_1 – first value of the *fuzzy* number,

m_2 – second value of the *fuzzy* number, and

m_3 – third value of the *fuzzy* number.

Step 2. Normalization of the deffuzificated initial decision-making matrix by the use of next mathematic formulas:

For criteria that have to be maximized:

$$r_{ij} = \frac{x_j - x_r^{**}}{x_j^{*} - x_j^{**}}$$

For criteria that have to be minimized:

$$r_{ij} = 1 - \frac{x_j - x_r^{**}}{x_j^{*} - x_j^{**}}$$

Where:

x_j^* – maximal attributes' value for the observed criteria,
x_j^{**} – minimal attributes' value for the observed criteria.

Step 3. Calculating the values of the standard deviation and the symmetric linear correlation matrix of all pairs per column.

Step 4. Determining the volume of information by the use of following mathematic formula:

$$C_j = \sigma_j \sum_{k=1}^{m} (1 - r_{jk}) \; j = \overline{1, m}$$

Where:

σ_j standard deviation of the criteria, and

r_{jk} correlation coefficient for the criteria.

Step 5. Calculating the final values by the use of following mathematic formula:

$$w_j = \frac{C_j}{\sum_{j=1}^{m} C_j}$$

CRITIC method assigns the larger weights to a criterion that has higher value of standard deviation, and which link to the other criteria is weaker (Zavadskas et al., 2019).

Fuzzy MARCOS method

MARCOS method is established by Stević et al. (2020). Method is in line to determined relations among alternatives and referent values of observed alternatives which are shown by ideal and ant-ideal points (coordinates). Process of decision making according the use of mentioned method is done in line to utility functions (Puška et al., 2020). Utility function represents an alternative towards the ideal and anti-ideal solution. The highly desired alternative is the closest to the ideal solution, while simultaneously the farthest to the anti-ideal solution (Stević, Brković, 2020; Mijajlović et al., 2020). Fuzzy version of the MARCOS method is developed by the Stanković et al. (2020). This method is conducting throughout the next steps:

Step 1. Forming of initial *fuzzy* matrix for the decision-making.

Step 2. Extension of initial *fuzzy* matrix for the decision-making.

Within the mentioned step the initial matrix is enlarging with the anti-ideal (AAI) and ideal solution (AI). AAI represents the alternative that has the worst characteristics, while AI represents the alternative with the best possible characteristics (Mijajlović et al., 2020).

Anti-ideal solution (AAI) is calculating by the use of next mathematic formula:

$$\mathrm{AAI} = \min_{j} \mathrm{x}_{ij} \quad \text{if } \mathrm{j} \in \mathrm{B} \quad \text{and} \quad \max_{j} \mathrm{x}_{ij} \quad \text{if } \mathrm{j} \in \mathrm{C}$$

Ideal solution (AI) is calculating by the use of next mathematic formula:

$$\mathrm{AI} = \max_{j} \mathrm{x}_{ij} \quad \text{if } \mathrm{j} \in \mathrm{B} \quad \text{and} \quad \min_{j} \mathrm{x}_{ij} \quad \text{if } \mathrm{j} \in \mathrm{C}$$

B is the benefit criteria which have to be maximized. C is the cost criteria which have to be minimized.

Step 3. Normalization of initial *fuzzy* matrix for decision-making. Normalization is conducting by the use of next mathematic formulas, depending which criterion is observed:

$$\tilde{n} = \left(n_{ij}^{l}, n_{ij}^{m}, n_{ij}^{u}\right) = \left(\frac{x_{id}^{l}}{x_{ij}^{u}}, \frac{x_{id}^{l}}{x_{ij}^{m}}, \frac{x_{id}^{l}}{x_{ij}^{l}}\right) \; if\; j \in C$$

$$\tilde{n} = \left(n_{ij}^{l}, n_{ij}^{m}, n_{ij}^{u}\right) = \left(\frac{x_{ij}^{l}}{x_{id}^{u}}, \frac{x_{ij}^{m}}{x_{id}^{u}}, \frac{x_{ij}^{u}}{x_{id}^{u}}\right) \; if\; j \in B$$

Where:

l – first *fuzzy* number,

m – second *fuzzy* number, and

i – third *fuzzy* number.

Step 4. Weighting of normalized decision-making matrix is conducting by the use of next mathematic formula:

$$\tilde{v}_{ij} = \left(v_{ij}^{l}, v_{ij}^{m}, v_{ij}^{u}\right) = \tilde{n}_j \times \tilde{w}_j$$

Step 5. Calculating the matrix *Si* considers the summing of all values per the rows, i.e. summing of all alternatives including the anti-ideal and ideal solutions by the use of next mathematic formula:

$$S_i = \sum_{i=1}^{n} v_{ij}$$

Step 6. Calculating the level of efficiency K_i towards the anti-ideal and ideal solution is conducting by the use of next mathematic formulas:

$$\tilde{K}_i^- = \left(\frac{\tilde{S}_i}{\tilde{S}_{ai}}\right) = \left(\frac{s_i^l}{s_{ai}^u}, \frac{s_i^m}{s_{ai}^u}, \frac{s_i^u}{s_{ai}^u}\right)$$

$$\tilde{K}_i^+ = \left(\frac{\tilde{S}_i}{\tilde{S}_{id}}\right) = \left(\frac{s_i^l}{s_{id}^u}, \frac{s_i^m}{s_{id}^u}, \frac{s_i^u}{s_{id}^u}\right)$$

Step 7. Calculating the fuzzy matrix $\tilde{T}_i$ is conducting by the use of next mathematic formula:

$$\tilde{T}_i = \tilde{t}_i = \left(t_i^l, t_i^m, t_i^u\right) = \tilde{K}_i^- + \tilde{K}_i^+ = (\tilde{k}_i^{-l} + \tilde{k}_i^{+l}, \tilde{k}_i^{-m} + \tilde{k}_i^{+m}, \tilde{k}_i^{-u} + \tilde{k}_i^{+u})$$

Determination of fuzzy number $\tilde{D}$ is done according the next mathematic formula:

$$\tilde{D} = (d^l, d^m, d^u) = \max_i \tilde{t}_{ij}$$

Step 8. Defuzzification of fuzzy numbers is done in line to following mathematic formula:

$$df_{def} = \frac{l + 4m + u}{6}$$

Step 9. Defining the utility function *f(Ki)* considers summing of all utility functions towards to a) anti-ideal and b) ideal solution.

a) Utility function in line to anti-ideal solution

$$f(\tilde{K}_i^+) = \frac{\tilde{K}_i^-}{df_{def}}$$

b) Utility function in line to ideal solution

$$f(\tilde{K}_i^-) = \frac{\tilde{K}_i^+}{df_{def}}$$

Step 10. Calculating the final utility function is conducting towards the next mathematic formula:

$$f(K_i) = \frac{K_i^+ + K_i^-}{1 + \frac{1 - f(K_i^+)}{f(K_i^+)} + \frac{1 - f(K_i^-)}{f(K_i^-)}};$$

Step 11. Ranking the alternatives. As optimal alternative could be considered alternative that has the highest value. As unattractive alternative could be considered alternative that has the minimal value.

Research results

First step in calculating the MCDA (Multiple-criteria decision analysis) is forming of the initial decision-making matrix. As research assumes expert decision-making based on attributive values of the alternatives, before all, the initial decision-making matrix will be presented (Table 2.). Within the table, engaged experts are marked as decision makers (DM), so the first DM represents the first expert from the observed field of expertise.

Table 2. Initial matrix of decision making

DM1	C1	C2	C3	C4	C5	C6	C7	C8	C9
A1	G	MG	G	G	MG	M	MB	M	G
A2	MB	M	MB	MB	M	M	MG	MG	MG
A3	B	M	MB	B	M	M	MG	G	M
DM2	C1	C2	C3	C4	C5	C6	C7	C8	C9
A1	VG	G	MB	VG	G	M	MB	MG	MG
A2	MB	M	G	MB	MB	G	MG	M	M
A3	M	B	G	MB	M	G	G	M	M
DM3	C1	C2	C3	C4	C5	C6	C7	C8	C9
A1	G	MG	MB	G	MB	MB	B	MB	MB
A2	B	M	M	MB	MG	MG	MG	M	MG
A3	M	M	MG	B	MG	MG	G	M	MG
DM4	C1	C2	C3	C4	C5	C6	C7	C8	C9
A1	G	MG	B	G	MG	M	B	MB	M
A2	MB	MB	M	MB	M	MG	MG	M	MG
A3	MB	M	MG	MB	MB	MG	MG	M	MG

Source: According to authors' calculation.

Next step in MCDA method represents the transformation of attributive, i.e. linguistic values into the numeric values using the membership function (Table 1.). In order to respect the opinion of all experts the common matrix of decision making is formed. Forming of mentioned matrix is based on the use of arithmetic mean (Mijajlović et al., 2020).

This matrix is the base for the calculation of the criterions' weights by the CRITIC method, as well as for the ranking of alternatives by the fuzzy MARCOS method. Firstly, the weight of criterions will be determined, while later it will be made the ranking of all alternatives. The main reason should be find in fact that it is necessary to know all weights of criterion during the alternatives' ranking.

First step at CRITIC method is deffuzification of cumulative fuzzy matrix of decision-making. After that are conducted steps defined for CRITIC method, before all normalization, and later calculation of standard deviation and correlation, in order to determine the volume of information and then to determine the weights of criteria.

Table 3. Calculating the weight of the criteria based on CRITIC method

Standard deviation								
C1	C2	C3	C4	C5	C6	C7	C8	C9
0,539	0,543	0,503	0,544	0,577	0,577	0,538	0,511	0,556
Correlation								
C1	C2	C3	C4	C5	C6	C7	C8	C9
1,000	0,965	0,848	-0,966	0,990	0,990	0,959	0,898	-0,671
0,965	1,000	0,958	-1,000	0,992	0,992	1,000	0,982	-0,452
0,848	0,958	1,000	-0,957	0,915	0,915	0,964	0,995	-0,175
-0,966	-1,000	-0,957	1,000	-0,993	-0,993	-1,000	-0,982	0,455
0,990	0,992	0,915	-0,993	1,000	1,000	0,989	0,952	-0,559
0,990	0,992	0,915	-0,993	1,000	1,000	0,989	0,952	-0,559
0,959	1,000	0,964	-1,000	0,989	0,989	1,000	0,986	-0,431
0,898	0,982	0,995	-0,982	0,952	0,952	0,986	1,000	-0,277
-0,671	-0,452	-0,175	0,455	-0,559	-0,559	-0,431	-0,277	1,000
$\sum_{k=1}^{m}(1-r_{jk})$								
C1	C2	C3	C4	C5	C6	C7	C8	C9
0,000	0,035	0,152	1,966	0,010	0,010	0,041	0,102	1,671
0,035	0,000	0,042	2,000	0,008	0,008	0,000	0,018	1,452
0,152	0,042	0,000	1,957	0,085	0,085	0,036	0,005	1,175
1,966	2,000	1,957	0,000	1,993	1,993	2,000	1,982	0,545
0,010	0,008	0,085	1,993	0,000	0,000	0,011	0,048	1,559
0,010	0,008	0,085	1,993	0,000	0,000	0,011	0,048	1,559
0,041	0,000	0,036	2,000	0,011	0,011	0,000	0,014	1,431
0,102	0,018	0,005	1,982	0,048	0,048	0,014	0,000	1,277
1,671	1,452	1,175	0,545	1,559	1,559	1,431	1,277	0,000
$C_j = \sigma_j \sum_{k=1}^{m}(1-r_{jk})$								
C1	C2	C3	C4	C5	C6	C7	C8	C9
2,148	1,934	1,780	7,845	2,144	2,144	1,906	1,787	5,937
w								
C1	C2	C3	C4	C5	C6	C7	C8	C9
0,078	0,070	0,064	0,284	0,078	0,078	0,069	0,065	0,215

Source: According to authors' calculation

The highest weight was given to the criterion C4 - Convenience of handling, as at this criterion there was the greatest dispersion in answers of experts that are observed the alternatives.

After the criterion weights were calculated, the steps from the fuzzy MARCOS method were applied. The first step after the forming of cumulative fuzzy matrix of decision-making was the finding of ideal and anti-ideal solutions. First one represents the highest value of alternatives for a certain criterion, while the anti-ideal solution represents the lowest value of alternatives for a certain criterion. In this way, the decision-making matrix is enlarged with ideal and anti-ideal solution. Further step in the fuzzy MARCOS method is normalization of the cumulative fuzzy matrix of decision-making. Since the nine criteria were used in observed research, where 5 of them represent benefit criteria, while 4 of them are the cost criteria, both normalization formulas were used. After normalization of the cumulative fuzzy matrix of decision-making, its weighting was done. This process is done by multiplying the values of normalized matrix of decision-making with the appropriate weights for certain criteria. Next step considers calculating the values of the *Si* matrix, which involves summing of all alternatives' values including the anti-ideal and ideal solution. After that, the level of efficiency *Ki* related to value of anti-ideal and ideal solution was calculated. Further, the fuzzy matrix that represents the sum of levels of efficiency related to ideal and anti-ideal solution was calculated. Then, at fuzzy matrix the maximal values for the certain fuzzy numbers are determining, while it was done the defuzzification of obtained values, so on that way was gained the value df_{def} = 2.50. This value is required in order to calculate the utility function.

Table 4. Calculation of sum, level of efficiency and fuzzy matrix $\tilde{T}_i$

	S_i	K_i^-	K_i^+		$\tilde{T}_i$	
Ideal	1,62 0,92 0,74	2,18 1,00 0,46	3,59 1,86 1,07			
A1	0,94 0,72 0,63	1,26 0,78 0,39	2,08 1,45 0,91		3,34 2,23 1,30	
A2	1,35 0,70 0,58	1,82 0,76 0,36	2,99 1,42 0,83		4,81 2,18 1,19	
A3	1,15 0,70 0,57	1,55 0,75 0,35	2,56 1,40 0,82		4,11 2,15 1,17	
Anti-ideal	0,69 0,50 0,45	0,93 0,54 0,28	1,53 1,00 0,65	max	4,81 2,23 1,30	2,50

Source: According to authors' calculation

Calculating the utility function was based on the values of level of efficiency and df_{def}. After that, it was done the defuzzification of the levels' of efficiency and utility function, while the final utility function was calculated. Based on the value of the final utility function, the ranking of all alternatives was performed. In this research, the best ranked alternative is A2 – by tractor carried (hydraulic) apple tree shaker. Next one is A3 - apple tree shaker on a towed machine, while the last one alternative is A1 – manual apple tree shaker with hydraulic or pneumatic drive.

Table 5. Calculation of utility function, defuzzification and ranking of alternatives

	$f(\widetilde{K}_i^{-})$	$f(\widetilde{K}_i^{+})$	DK_i^-	DK_i^+	D	D	$f(K_i)$	Rank
A1	0,83 0,58 0,36	0,50 0,31 0,16	0,794	1,463	0,585	0,317	0,584	3
A2	1,20 0,57 0,33	0,73 0,30 0,14	0,869	1,581	0,632	0,347	0,708	1
A3	1,02 0,56 0,33	0,62 0,30 0,14	0,819	1,497	0,598	0,327	0,622	2

Source: According to authors' calculation

In order to confirm the obtained results and determine the sensibility of alternatives towards the change in criteria' weights, the sensitivity analysis was performed.

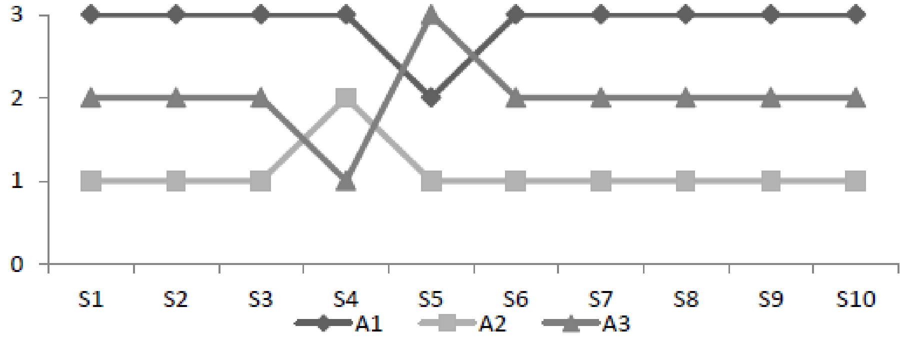
Table 6. Scenarios for sensitivity analysis implementation

	C1	C2	C3	C4	C5	C6	C7	C8	C9
Scenario 1	0,111	0,111	0,111	0,111	0,111	0,111	0,111	0,111	0,111
Scenario 2	0,360	0,080	0,080	0,080	0,080	0,080	0,080	0,080	0,080
Scenario 3	0,080	0,360	0,080	0,080	0,080	0,080	0,080	0,080	0,080
Scenario 4	0,080	0,080	0,360	0,080	0,080	0,080	0,080	0,080	0,080
Scenario 5	0,080	0,080	0,080	0,360	0,080	0,080	0,080	0,080	0,080
Scenario 6	0,080	0,080	0,080	0,080	0,360	0,080	0,080	0,080	0,080
Scenario 7	0,080	0,080	0,080	0,080	0,080	0,360	0,080	0,080	0,080
Scenario 8	0,080	0,080	0,080	0,080	0,080	0,080	0,360	0,080	0,080
Scenario 9	0,080	0,080	0,080	0,080	0,080	0,080	0,080	0,360	0,080
Scenario 10	0,080	0,080	0,080	0,080	0,080	0,080	0,080	0,080	0,360

Source: According to authors' calculation

The main task of sensitivity analysis is to examine how many certain criterions affect the alternatives' ranking. According to that 10 scenarios were created (Table 6.). First scenario gives the unique importance to the all criteria, so in line to that they were assigned the weight of 0.111. Other scenarios are giving the advantage to the one of the criteria, while to this a criterion is assigned the 4.5 times higher importance compared to other criteria. As there are 9 criteria, there will be 10 scenarios in line to different criteria' weight. Visual presentation of the results of sensitivity analysis is done by the next picture (Picture 1.).

Figure 1. Results of sensitivity analysis



Source: According to authors' calculation

Conclusion

The results of the performed research and sensitivity analysis are showing that at eight scenarios the ranking of alternatives have not been changed. In scenario 4 and 5 there comes to the change in alternatives' ranking. In scenario 4, advantage has the alternative A3 related to alternative A2. This scenario shows that alternative A3 has better efficiency of usage compared to the alternatives A2 and A1, so according to that, alternative A3 in this scenario is better ranked towards the other alternatives. In scenario 5 is shown that alternative A1 has better convenience of handling related to alternative A3. Respecting the all results for the alternative ranking it could be concluded that the alternative A2 – by tractor carried (hydraulic) apple tree shaker has the best performances related to other alternatives. It is followed by the alternative A3 - apple tree shaker on a towed machine, while the worst results after expert analysis are gained to the alternative A1 – manual apple tree shaker with hydraulic or pneumatic drive. At the end, as the best choice for the apple harvesting (considering tree shaking) was considered by the tractor carried (hydraulic) apple tree shaker.

Literature

1. Blagojevića, B., Srđević, B. Srđević, Z., Zoranović, T. (2017): Grupno odlučivanje pomoću Analitičkog hijerarhijskog procesa. *Annals of agronomy,* 41(1):30-39.
2. Diakoulaki, D., Mavrotas, G., Papayannakis, L. (1995): Determining objective weights in multiple criteria problems: The CRITIC method. *Computers & Operations Research*, 22(7):763-770, doi: 10.1016/0305-0548(94)00059-h

3. Draginčić, J., Korać, N., Blagojević, B. (2015): Group multi-criteria decision making (GMCDM) approach for selecting the most suitable table grape variety intended for organic viticulture. *Computers and Electronics in Agriculture*, 111:194-202, doi:10.1016/j.compag.2014.12.023
4. Ivanović, L., Jeločnik, M. (2009): Analysis and planning of apple production as factor of rural development support. *Economic analysis*, 42(3-4):78-85.
5. Jeločnik, M., Subić, J., Kovačević, V. (2019): Competitiveness of apple processing. *Ekonomika*, 65(4):41-51.
6. Khandekar, A.V., Chakraborty, S., (2015): Selection of material handling equipment using fuzzy axiomatic design principles. *Informatica* 26:259-282.
7. Kiani Mavi, R., Goh, M., Kiani Mavi, N. (2016): Supplier selection with Shannon entropy and fuzzy TOPSIS in the context of supply chain risk management. *Procedia - Social and Behavioral Sciences*, 235:216-225.
8. Maksimović, A., Grgić, Z., Ćejvanović, F. (2017): Multi-attribute analysis of orchard according to the integrated production concept. *Ekonomika poljoprivrede*, 64(1):69-79, doi: 10.5937/ekoPolj1701069M
9. Maksimović, A., Grgić, Z., Puška, A., Šakić Bobić, B., Ćejvanović, F. (2018): Primjena višekriterijskog odlučivanja za izbor optimalne sorte jabuke za sjeverozapadnu regiju BiH. *Journal of Central European Agriculture*, 19(3):740-759, doi: 10.5513/JCEA01/19.3.2062
10. Mijajlović, M., Puška, A., Stević Ž., Marinković, D., Doljanica, D., Virijević Jovanović, S., Stojanović, I., Beširović, J. (2020): Determining the Competitiveness of Spa-Centers in Order to Achieve Sustainability Using a Fuzzy MultiCriteria Decision-Making Model. *Sustainability,* 12:8584, doi:10.3390/su12208584
11. Milovanović, Ž., Stojanović, M. (2016): Izbor sorti višnje za sadnju primenom AHP metodologije, *Agroekonomika*, 45(72):11-19.
12. Nedeljković, M., Potrebić, V. (2020): Forecasting of apple production in the Republic of Srpska. *Western Balkan Journal of Agricultural Economics and Rural Development*, 2(1):21-29.
13. Paunović, M., Milutinović, O., Puzić, G. (2018): Personal subjectivity impact reduction in choice of sour cherry varieties for orchard establishment using fuzzy system. *Economics of Agriculture*, 65(2):545-554, doi: 10.5937/ekoPolj1802545P

14. Puška, A., Beganović, A., Šadić, S. (2018): Model for investment decision making by applying the multi-criteria analysis method. *Serbian Journal of Management*, 13(1):7-28, doi: 10.5937/sjm13-12436
15. Puška, A., Stojanović, I., Maksimović, A., Osmanović, N. (2020): Evaluation software of project management used measurement of alternatives and ranking according to compromise solution (MARCOS) method. *Operational Research in Engineering Sciences: Theory and Applications*, 3(1):89-102, doi: 10.31181/oresta2001089p
16. Rozman, Č., Maksimović, A., Puška, A., Grgić, Z., Pažek, K., Prevolšek, B., Ćejvanović, F. (2017): The Use of Multi Criteria Models for Decision Support System in Fruit Production. *Erwerbs-Obstbau*, 59(3):235-243, doi: 10.1007/s10341-017-0320-3.
17. Sahu, A. K., Datta, S., Mahapatra, S. S. (2015): GDMP for CNC machine tool selection with a compromise ranking method using generalised fuzz circumstances. *International Journal of Computer Aided Engineering and Technology,* 7:92-108.
18. Stanković, M., Stević, Ž., Das, D. K., Subotić, M., Pamučar, D. (2020): A New Fuzzy MARCOS Method for Road Traffic Risk Analysis. *Mathematics*, 8:457, doi: 10.3390/math8030457
19. Stević, Ž., Brković, N. (2020): A Novel Integrated FUCOM-MARCOS Model for Evaluation of Human Resources in a Transport Company. *Logistics*, 4(1):4, doi: 10.3390/logistics4010004
20. Stević, Ž., Pamučar, D., Puška, A., Chatterjee, P. (2020): Sustainable supplier selection in healthcare industries using a new MCDM method: Measurement Alternatives and Ranking according to COmpromise Solution (MARCOS). *Computers & Industrial Engineering*, 140:106231, doi: 10.1016/j.cie.2019.106231
21. Turskis, Z., Zavadskas, E. K., Antucheviciene, J., Kosareva, N. (2015): A hybrid model based on fuzzy AHP and WASPAS for construction site selection. *International Journal of Computers communications & control*, 10(6):873-888.
22. Užar, D., Tekić, D., Mutavdžić, B. (2019): Analiza i predviđanje proizvodnje jabuke u Republici Srbiji i Bosni i Hercegovini. *Ekonomija, teorija i praksa*, 12(4):1-10.

23. Wu, Z., Ahmad, J., Xu, J. (2016): A group decision making framework based of fuzzy VIKOR approach for machine tool selection linguistic information. *Applied Soft Computing*, 42:314-324.
24. Zavadskas, E. K., Stević, Ž., Turskis, Z., Tomašević, M. (2019): A Novel Extended EDAS in Minkowski Space (EDAS-M) Method for Evaluating Autonomous Vehicles. *Studies in Informatics and Control*, 28(3):255-264, doi: 10.24846/v28i3y201902

ANALYSIS OF CONDITION OF FOREST OF THE TOWN OF SMEDEREVO IN ACCORDANCE WITH SUSTAINABLE RURAL DEVELOPMENT[1]

Nada Mijajlović[2]

Abstract

Forests are an important factor in improving the environment and forest management in Serbia is regulated at both the state and local level. In this paper, forest complexes on the territory of the city of Smederevo as the administrative center of the Danube region will be considered. This paper has the goal to analyze the state of the forest fund of the city of Smederevo and the possibilities of its improvement in the context of sustainable rural development. The city of Smederevo, as a strong industrial center of the Danube region, is strategically determined to improve the existing forest fund. The paper will present the current state of forests and, accordingly, what measures are planned to increase the area under forests with certain woody species.

Key words: *forests, sustainable rural development, Smederevo, forestry.*

Introduction

Forests as ecosystems are important for life on our planet in many ways. Of the total land area, 30% is under forest. (Food and Agriculture Organization, 2006) Forest ecosystems are made up of many different plant and animal species and in that sense contribute to the maintenance of biodiversity. In terms of primary production on Earth, forests produce 80% of biomass. (Pan Yude, et al., 2013) It has been established that forests are extremely important in the production of oxygen in the intensive metabolic process of photosynthesis, during which they bind carbon dioxide and form primary carbohydrates.

In urban areas, forest plantations, such as wild chestnuts, can significantly reduce the level of air pollution due to industrial and traffic activities.

Various harmful gases, dust, radioactive particles of the forest can be absorbed to a great extent and in that way purify the air of polluted urban environments. Depending on the type of forest and density, they are a significant factor in reducing noise.

1 The paper is the result of scientific research funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

2 Nada Mijajlović, M.Sc., Expert Associate, Institute of Agricultural Economics, Volgina no.15, 11060 Belgrade, Serbia, Phone: +381 11 69 72 854, E-mail: nada_m@iep.bg.ac.rs

Coniferous forests are efficient in the production of essential substances that disinfect the air, especially juniper trees. (http://ekovrba.com/sume-i-znacaj-suma.html)

Forest-covered areas in watercourses are protected from torrents that wash away and carry away soil around rivers. In that way, forests prevent soil erosion, and they are a good filter for water purification and obtaining drinking water.

Climate change is to some extent compensated by the presence of forest complexes. Forest exploitation, often uncontrolled, threatens the survival of forest communities, thus jeopardizing the survival of the planet.

Forests play a very important role in the global carbon cycle. Forests are a source of carbon, they are important in terms of binding and retention carbon. Forests and land to which they are attached by the root system have a large capacity to accumulate and release carbon. (Mijajlović, 2015)

Sustainable development as a concept implies the use of existing available, natural resources in order to meet the needs of present generations, while implying that they do not jeopardize the ability of future generations to use these resources. Forests have been given their special place in the context of sustainable development as renewable resources that can be maintained and improved with protection and care. Legislation and legal norms for the protection and planned exploitation of forests have been established at the world level.

The Law on Forests (Law on Forests, "Official Gazette of the RS", No. 30/2010, 93/2012, 89/2015 and 95/2018) which applies in Serbia is adapted to international regulations at the state and local level and in accordance with that is taking measures to protect and improve forest ecosystems. Based on the annual plans, the public companies "Srbijasume" and "Vojvodinashume" perform artificial afforestation and planned deforestation within the existing forests and outside the forests. (https://upravazasume.gov.rs/wp-content/uploads/2015/12/Strategija-razvoja-sumarstva.pdf)

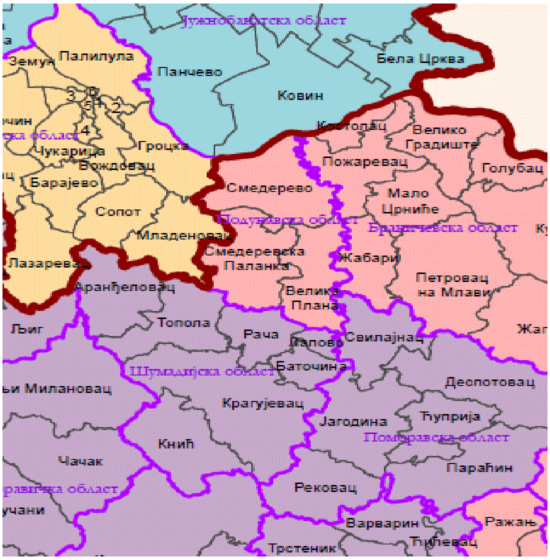
The forest fund, which occupies about 30% of the territory of the Republic of Serbia, is composed of deciduous forests mainly (90.7%), conifers have significantly less (6.0%), while the smallest percentage is mixed forests (3.3%). Beech forests with 27.6% are dominant, followed by oak forests 24.6%, other hardwoods 6.0%, poplar 1.9%, other softwoods 0.6% and mixed hardwood forests 30%. State-owned forests in Serbia have unfavorable age structures, unsatisfactory growth and health condition, and there is a large share of stands with broken structures and weedy areas due to unplanned, uncontrolled and often illegal logging and exploitation. (http://www.fornetserbia.com/doc/shared/Strategija_razvoja_sumarstva.pdf)

Climate change has had an impact on forest communities in Serbia. Due to climate change, the boundaries of certain types of forests have shifted in relation to latitude and altitude. There have been changes in the composition of some forest communities, changes in the relationship of individual forest communities to light. It is considered that all these changes have a cumulative effect and thus endanger the biodiversity of forest communities. In addition, the management of forest resources on the principles of sustainable development is also difficult to achieve. (Medarević et al., 2007)

Forest fund of the city of Smederevo

The city of Smederevo is the center of the Danube district. It is located on the banks of the Danube River in the northeastern part of Serbia. (Fig. 1). Smederevo is composed of 11 local communities. Geographical position and climate determine that two thirds of the land of this city are suitable for agricultural activities. The continental climate in Smederevo has been modified by the influence of the flows of the large rivers Danube and Velika Morava, but also small ones, which can lead to colder winters. The largest number of agricultural farms on the territory of Smederevo is engaged in the cultivation of field and vegetable crops. Areas under forest are mostly privately owned. The state forests are under the management of the Forest Company - Pozarevac, within Srbijasume. Due to the larger share of private ownership over forests, the data in the available literature on areas under forests also differ. (https://www.agromedia.rs/opstine/smederevo-grad/)

Figure. 1. Map of the Danube area with the town of Smederevo as the center



Source site: internet reference No.5.

According to the available data from the 2012 census of agriculture, which are shown in Table 1, of the total forest land at the level of the Danube region, 31.25% is located in the city of Smederevo. At the level of the Danube District, since it is a very fertile land of the first and second class, agricultural and vegetable production has been developed and forests have been suppressed and reduced to very small areas.

Table 1. Comparative overview of total available land and forest land at the level of the Republic of Serbia, the Danube District and the City of Sederevo.

Area	Available land (ha)	Forest land (ha)
Republic of Serbia	5346596.52	1023035,53
Danube District	94747.66	4458.22
Town Smederevo	38494,87	1393,42

Source: Census of Agriculture Data, 2012. http://popispoljoprivrede.stat.rs/?page_id=6221

Based on the data from Table 1, it can be noticed that 3.6% of the total territory of the city of Smederevo is under forest areas. Due to the fact that large areas of fertile land are being actively cultivated, it is difficult to implement the plans related to afforestation at the level of this city.

Based on the Review of the Basics of Forest Management of the Public Company "Srbijašume" from 2013, the total area under forests for the city of Smederevo was 1598.32 ha, of which private forests occupied 1402 ha and the remaining 196.32 ha were state-owned under the Forest Administration Požarevac. Based on this document, the Danube District had a forest area of 106,456.78 ha, of which 64,372 ha was private property, while the remaining 42,084.78 ha was in state ownership under the management of the competent forest companies. (https://www.srbijasume.rs/pdf/30osnove.pdf)

According to statistical data from 2019, the forest fund is 1519 ha, which is 3.62% of the total territory of the town of Smederevo (38494.87 ha). (Municipalities and regions in the Republic of Serbia, 2019).

Strategic documents and plans at the level of the Town of Smederevo envisage the protection of existing and the establishment of new forest plantations. Actions of afforestation, renewal and rejuvenation of the forest fund are being implemented slowly for now. In terms of the composition of the existing forest fund, there are mostly poplars and willows, and ash, maple and oak forests are less represented. Oak, malt and cera forests are of the climatogenic type and it is therefore necessary to restore these forests and afforest larger areas with seedlings of these woody species. Afforestation measures must be intensified in order to ennoble and improve the environmental conditions of this industrialized city.

Conclusion

The city of Smederevo as the administrative center of the Danube region is industrially developed. Fertile land areas on the territory of this city are used for agricultural activities of growing monocultures of field and vegetable crops. The forest fund of the city of Smederevo is scarce, but in relation to the entire forest fund of the Danube region, it makes up one third. It must be pointed out that at the level of local government there are strategic plans and a commitment to change this situation. Planned measures to expand the area under forests are being taken slowly and it is necessary to develop awareness of the importance of the concept of sustainable development, which would speed up the process of afforestation and improvement of the forest fund of the city of Smederevo.

Literature

1. Census of Agriculture Data, 2012: *Republic of Serbia*
2. Forest resources of Europe, Cis, North America, Australia, Japan and New Zealand (TBFRA), (2006), UNECEFAO, Rome.

3. Law on Forests, “Official Gazette of the RS”, No.30/2010, 93/2012, 89/2015 and 95/2018
4. Municipalities and regions in the Republic of Serbia, 2019.
5. Medarević, M., Banković, S., Šljukić, B., Slivicic, A. (2007): *Sustainable forest management - forest biodiversity and climate change.* In Forests and Climate Change. Proceedings. University of Belgrade - Faculty of Forestry, Belgrade. 125-152.
6. Nada Mijajlović, (2015) : *Analysis of the situation and the importance of forestry in the context of sustainable development* in Serbia, 6th Edition of the International Symposium, Agrarian Economy and Rural Development, Realities and perspectives for Romania, organizer: Research Institute for Agricultural Economy and Rural Development, Editura ASE, November 2015, Bucharest, ISSN 2285-6803, ISSN-L 2285-6803, pp. 337-341, Web site: http://www.iceadr.ro/
7. Pan, Yude; Birdsey, Richard A.; Phillips, Oliver L.; Jackson, Robert B. *(2013): „The Structure, Distribution, and Biomass of the World's Forests" (PDF). Annu. Rev. Ecol. Evol. Syst.* ***44****: 593—62.* doi:10.1146/annurev-ecolsys-110512-135914.*)*

Internet sources:

8. http://ekovrba.com/sume-i-znacaj-suma.html (18.09.2020.)
9. https://upravazasume.gov.rs/wpcontent/uploads/2015/12/Strategija-razvoja-sumarstva.pdf (19.09.2020.)
10. http://www.fornetserbia.com/doc/shared/Strategija_razvoja_sumarstva.pdf) (19.09.2020.)
11. https://www.agromedia.rs/opstine/smederevo-grad/ (20.09.2020)
12. https://www.google.com/search?q=Opstina+velika+plana&rlz=1C1CHBF_enRS832RS833&sxsrf=ALeKk01NAxfneazGYP_ePV-5zs-5gHVkpVg:1606095504501&source=lnms&tbm=isch&sa=X&ved=2ahUKEwjp4JSAxJftAhUI3qQKHfKPB5kQ_AUoAnoECB8QBA&biw=1366&bih=600#imgrc=AhBNh8SyMHO6VM (20.09.2020.)
13. http://popispoljoprivrede.stat.rs/?page_id=6221 (23.09.2020.)
14. https://www.srbijasume.rs/pdf/30osnove.pdf (24.09.2020.)

IRRIGATION AS A FACTOR OF ECONOMIC SUSTAINABILITY OF AGRICULTURAL PRODUCTION

Nataša Kljajić[1], *Zorica Sredojević*[2]

Abstract

The subject of research in this paper are the economic parameters of application of irrigation, as important agro-technical measure in agricultural production of the Republic of Serbia. Measures considered are based on the available data of the SORS and the records of other relevant institutions, ten-year trends of irrigated areas, sources of water intake, and more importantly ways of applying irrigation. The aim of the research is to analyze the results of the development so far, to consider the shortcomings and the possibility of improving the irrigation measure in the agricultural practice of the Republic of Serbia.

Key words: *water abstractions, areas, irrigation methods.*

Introduction

The Republic of Serbia has favorable land and water potential for intensive agricultural production. Areas suitable for agricultural production are most common in the north of the Republic of Serbia and in the valleys of watercourses. "Serbia experienced considerable land use changes in the first half of the nineteenth century due to an increased demand for agricultural products" *(Tolimir et al., 2020)*. Efficient, high and stable agricultural production is limited by a large number of factors, among which are among others, insufficient but also unevenly distributed precipitation in the vegetation period as well as the occurrence of shorter or longer dry periods *(Kljajić, 2014)*. Therefore, in our climatic conditions, the need for irrigation is more and more pronounced, both through the construction of new systems and through a higher degree of utilization of existing ones. The application of irrigation leads to multiple benefits, such as: rational use of natural resources; reduction or complete elimination of the effects of drought; favorable harmonization of soil-water-plant-atmosphere relations; high yields (production volume); higher income, and thus a better standard of living *(Sredojević & Gajić, 2020)*.

1 Nataša Kljajić, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 60 484 95 550, E-mail: natasa_k@iep.bg.ac.rs

2 Zorica Sredojević, Ph.D., Full Professor, University of Belgrade, Faculty of Agriculture, Nemanjina no. 6, 11080 Belgrade, Phone: +381 11 441 32 97, E-mail: zokas@agrif.bg.ac.rs

In general, irrigation is very important in modern plant production, especially on landscaped areas with regulated excess water. When applied correctly, more advanced cultivation of agricultural crops with safe, high and quality yields is achieved, according to the needs of industry and the market. In order for irrigation to give the maximum effect, it is necessary to pay attention to the appropriate choice of technology that will be applied and the choice of irrigation method, i.e. type of system, all with the goal of rational and economical supply of water to plants. Appropriate watering norms must be determined, and attention must be paid to the quality of water used for irrigation, due to the consequences of increasing pollution of the affected waters *(Kljajić, 2012).* When planning production in irrigation conditions, it is necessary to consider in detail the economic advantages and disadvantages, as well as the environmental consequences. "Costs that address the issue of environmental liability, in some cases, exceed the value of the assets in many cases, so that their precise calculation requires determination of the ecological, physical, geological and hydro-geological characteristics of the site, as well as the type and quantity of harmful substances"*(Sredojević et al., 2019).*

Therefore, the subject of research in this paper is the analysis of selected economic parameters of the current development of irrigation in our country. The aim of the research is to examine the trends in the movement of irrigated areas, sources of intervention and methods of irrigation in the past ten years, in order to improve and more efficient application of this agro-technical measure.

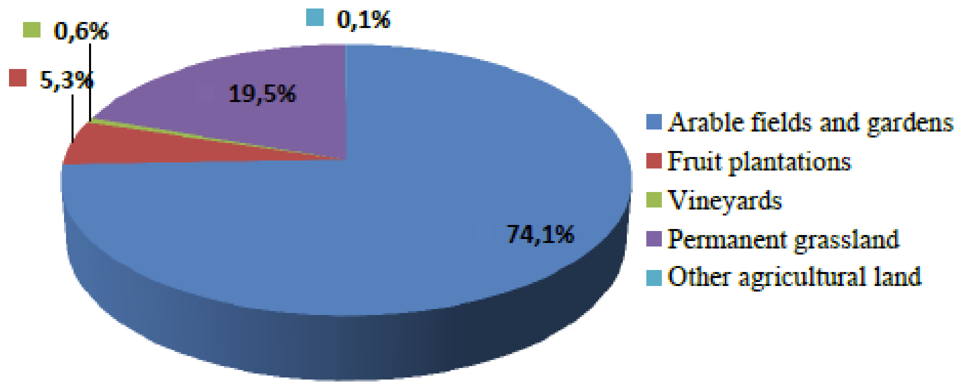
Material and Methods

For the research in this paper, the databases of statistical data of the Statistical Office of the Republic of Serbia were used, as well as data from the records of other relevant institutions in the Republic of Serbia. The structure of use, agricultural areas ten - year trends in the representation of areas under irrigation, the distribution of areas suitable for irrigation, sources of water abstraction, as well as areas under certain ways of irrigation application are considered.

Results and Discussions

Irrigated areas in the Republic of Serbia - Out of the total available land area in the Republic of Serbia, the used agricultural area is 3,481,567 ha *(SORS, 2020).* Of that, 2,578,898 ha are arable land and gardens, 675,314 ha are grasslands (meadows and pastures), then 206,228 ha are under perennial plantations (orchards, vineyards, nurseries, etc.), and 21,127 ha are backyards. In the total used agricultural area in 2019, arable land and gardens participated with 74.1%, orchards with 5.3%, vineyards with 0.6%, meadows with 9.9% and pastures with 9.5% (Graph. 1).

Figure 1. Structure of used agricultural land, 2019.



Source: https://publikacije.stat.gov.rs/G2020/Pdf/G20201006.pdf

From the aspect of convenience of application of irrigation measures, the following classes of land can be distinguished *(Miljković, 2005):*

- *Class I* - deep soils suitable for irrigation without restrictions, with systematic periodic control of the quantity and quality of irrigation water and groundwater regime “first” issued;
- *Class II* - deep and medium deep soils suitable for irrigation with some caution, due to degradation processes under the influence of which they were in the past;
- *Class IIa* - medium-deep soils suitable / conditionally suitable for irrigation (valley soils with present variability in morphological, physical, water-physical and chemical terms);
- *Class III* - soils conditionally suitable for irrigation, clay mechanical composition, stagnation, salinity and alkalinity;
- *Class IIIa* - deep soils (mostly hydromorphic), which requires appropriate drainage and dispersal of unfavorable layers;
- *Class IIIb* - medium-deep soils, which requires appropriate drainage, application of small amounts of physical and chemical means for soil repair and other land reclamation measures;

- *Class IIIv* - deep, medium deep to shallow soil, which requires appropriate drainage and application of significant physical and chemical means for soil repair.

Suitable lands for irrigation include all class I and class II (IIa) lands, as well as class III lands that require partial (IIIa) or complex reclamation (hydro, agro and chemical - IIIc). Class I and II land is dominant in the northern part, and class IIa land is represented in the central and southern part of the Republic of Serbia. Class IIIa and IIIb land is evenly represented on the entire territory of the Republic, while class IIIc covers longer parts of the Podrinje-Kolubara area and the entire territory of the upper Morava area. In our country, without restrictions or with some caution, about 1.9 million ha can be irrigated, of which about 70% on the territory of AP Vojvodina. Conditionally suitable lands for irrigation, with significant previous investments, cover about 2.6 million ha, which together with the previous classes makes almost 4.5 million ha (Table 1).

Table 1. Distribution of areas suitable for irrigation (ha)

The class land	Water areas						Total
	Bačka and Banat	***Srem***	***Belgrade***	***Sava***	***Morava***	***Lower Dan-ube***	
I	444,749	98,633	14,414	1,470	23,000	51,224	633,490
II	706,622	105,560	36,249	7,553	2,636	23,471	883,091
IIa	14,685	1,176	32,690	48,352	221,160	63,990	382,053
IIIa	241,488	42,101	78,600	18,109	278,784	129,181	788,263
IIIb	285,080	92,405	105,841	43,600	413,220	90,618	1,030,764
IIIv	79,122	21,718	38,463	269,692	179,600	150,245	738,840
Un-suit-able	1,803	14,463	18,427	631,003	2,063,202	561,866	3,290,764
Svega:	1,773,549	377,056	324,684	1,019,779	3,181,602	1,070,595	7,747,265

Source: https://www.jcerni.rs/oblasti/navodnjavanje-i-odvodnjavanje/

Irrigation in our country is not at a satisfactory level, neither in terms of volume nor in terms of technical equipment, and therefore not in terms of the degree of use. Economic problems have caused stagnation in all economic branches of our country, including agriculture and even irrigation. Looking back at a period of ten years, it can be stated that less than 1.5% of arable land is intensively irrigated. The most common reasons for the low level of use of existing irrigation systems are the unfavorable position of agriculture, insufficient equipment of farms with irrigation equipment, as well as the general lack of financial resources for maintenance of devices and operation of irrigation systems.

The unsatisfactory volume of irrigation in our country can be seen on the basis of the data in Table 2, which are for the period 2010-2019, where the areas and methods of irrigation are shown.

Table 2. Areas and methods of irrigation in the R. of Serbia, 2010-2019.

Years									
2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Used agricultural land (000 ha)									
5,091	5,058	5,056	5,069	3,505	3,468	3,440	3,438	3,437	3,437
Irrigated land (ha)									
25,128	34,175	52,986	53,086	44,882	54,696	43,486	50,366	46,937	46,863
The share of irrigated areas in the total used agricultural land (%)									
0.5	0.8	1.0	1.0	1.3	1.8	1.3	1.5	1.4	1.4
Surface irrigation (ha)									
1,261	1,525	2676	707	141	127	53	94	51	59
Sprinkling (ha)									
22,442	30,965	47,742	49,403	42,215	52,200	40,651	47,374	44,065	43,253
Dripping (ha)									
1,425	1,685	2,567	2,976	2,526	2,369	2,782	2,898	2,821	3,550

Source*:* https://publikacije.stat.gov.rs/G2020/Pdf/G20201006.pdf

Irrigation is applied in a small percentage in relation to the total used agricultural land. The dominant method of irrigation is sprinkling (artificial rain), followed by drip or drip system, while surface irrigation is applied to the least extent, to the least agricultural areas. There are about 2,000 ha on technically rounded systems on the experimental estates in agricultural schools, while locally, around the backyards, there are on about 10,000 ha of technically unrounded systems, so that under the built systems in public and private ownership there are about 145,000 ha, while some the form of irrigation covers a total of about 100,000 ha of agricultural land (Water Management Strategy on the territory of the Republic of Serbia until 2034). According to the data of the distributors of irrigation equipment, in addition to the mentioned areas, another 45,000 ha are irrigated with individual privately owned systems (Table 3).

Table 3. Irrigated areas in public and private ownership, 2012.

No.	Name of the water area	Surface area (ha)			Total in function
		Public property*	Private property **	Technically rounded	
1.	Bačka and Banat	29,028	10,136	6,055	45,219
2.	Srem	1,134	1,853	1,112	4,099
3.	Belgrade	1,912	2,435	1,095	5,442
4.	Sava	5,000	5,076	2,538	12,614
5.	Morava	3,840	6,000	2,400	12,240
6.	Lower Danube	no data	4,500	1,800	6,300
Total:		40,914	30,000	15,000	85,914

Source: Water Management Strategy on the territory of the Republic of Serbia until 2034, reference year 2012.

Notice: * data from public water companies

** equipment distributor data

Mostly surface water is used for irrigation by direct abstraction from rivers, regional hydro systems, reservoirs and canal networks. Groundwater sources for irrigation are most often wells within the "first" issued (groundwater reservoirs, formed in aquifers of the Late Quaternary), which is shown in Table 4.

Table 4. Use of water for irrigation, 2011-2019.

Abstracted / taken water, 1000 m3 per year									Average
2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	
Underground waters									
1,400	5,768	4,535	1,26	7,131	2,094	3,322	3,437	3,466	3,642.1
Watercourse									
61,168	100,160	80,027	47,640	75,952	40,381	67,382	48,159	61,020	64,654.3
Reservoirs and lakes									
3,224	4,401	3,213	1,297	5,368	2,811	4,520	2,918	-	***3,469***
Plumbing system									
-	116	355	33	54	30	41	-	-	***104.8***
Total									
66,092	110,45	88,130	50,596	88,505	45,316	75,265	54,540	67,692	

Source: https://www.stat.gov.rs/

Observing the period 2011-2019, it can be stated that in Serbia, on average, a total of 71,8420,000.3 m3 of water is captured, namely 3,642,000.1 m3 from groundwater, 64,654,000.3 m3 from watercourses, 3,469,000 m3 from reservoirs and lakes and 104,000.8 m3 of water supply. About 70% of the world's water consumption goes to agriculture. That is why the topic of more rational consumption of water for irrigation is becoming more and more topical today *(Petković, 2003)*.

Irrigation improvement options - Experience from agricultural practice has recently shown that in our natural conditions, irrigation should not be treated only as an intervention measure to achieve high and stable yields. The importance of irrigation is far greater and is especially pronounced when introducing a modern and diverse sowing structure with plant crops that have fairly high water requirements. In some areas where irrigation is planned, there is a need to address drainage, so a double system should be applied. New irrigation systems should be built on lands of I, II, IIa, IIIa and IIIb classes of irrigation suitability. The water management bases of the Republic of Serbia envisage that the largest part of the system will be built by applying artificial rain, on over 90% of the areas. Drip irrigation will be applied in perennial plantations (orchards and vineyards), and only in newly designed ones. Surface irrigation (furrows, overflow) will be present on smaller local irrigation estates, and subrogation in the valleys of larger rivers, especially on those parts of alluvial plains (marshes) that are affected by slowdown on those rivers. The pace and direction of irrigation development will depend primarily on the strategy of agricultural production development (Water Management Strategy on the territory of the Republic of Serbia until 2034, "Official Gazette of RS", No. 3/2017).

According to *Sredojević et al*. (2020), "the realization of investments in irrigation achieves positive effects of sustainable use of natural resources, improvement of the quality of the environment and general, socio-economic and economic development of society". Economic indicators of investment justification are determined as the difference and the ratio between the amount of total investments made and night income that are achieved during the investment period. "In the case of public-private partnerships, with key indicators of economic viability and financial acceptability of the site, the analysis should show the financial effects that can be shared between the public and private sectors within the partnership" *(Stanković et al., 2013).* Investments in the irrigation system depend on the type of mobile equipment, irrigation hydro module, location of water intake, distance of energy sources, terrain configuration and others. The real development of irrigation presupposes the provision of technical, economic and social conditions. As they state *Potkonjak & Mačkić (2010),* an important factor in the development of irrigation is the structuring of primary agricultural production. Identification of all water users and relevant natural and socio-economic factors has a significant impact on irrigation, defining the water balance, existing and potential users and investor decisions. As part of the analysis of society from the aspect of water management, an integral part is the identification of stakeholders.

Conclusion

Based on the stated facts related to the statistics on irrigated areas in the Republic of Serbia, the general assessment is that irrigation is not at a satisfactory level and is not harmonized with the needs and possibilities of agriculture and water management. In the structure of irrigated crops, about 93.5% are field and vegetable crops, while only about 4.3% are modern orchards. Over 88% of water is taken from rivers and canals, while other areas are irrigated from groundwater, lakes and reservoirs. Irrigation by sprinkling is most common (93.9%), and about 6% by drip irrigation (most often irrigation of modern orchards and vineyards), and now the prevailing understanding is that the production of vegetables and seed crops is possible without modern irrigation systems.

The share of modern irrigation equipment - typhoon and drip irrigation - as the most economical method of irrigation is gradually increasing. The results of research in this paper show that, despite good natural conditions for the application of irrigation, it is insufficiently applied and currently has a negligible role in the development of overall agricultural production in our country. When creating the optimal variant of the system, it is necessary to perform an economic analysis with detailed economic parameters, with the aim of finding the most accurate water prices at the water intake and the final price for the user.

Note: The paper is the result of research within the contract on the implementation and financing of scientific research in 2020 of the Ministry of Education, Science and Technological Development of the Republic of Serbia, researchers at the Institute of Agricultural Economics, Belgrade, and researchers at the Faculty of Agriculture, Belgrade-Zemun, No. 451-03-68/2020-14/200116.

Literature

1. Kljajić, N. (2012): *Ekonomska efikasnost investicija u različitim uslovima proizvodnje maline.* Doktorska disertacija, Poljoprivredni fakultet Univerziteta u Novom Sadu. [in English: Kljajić, N. (2012): *Economic efficiency of investments in different conditions of raspberry production.* Doctoral dissertation, Faculty of Agriculture, University of Novi Sad]
2. Kljajić, N. (2014): *Efikasnost investicija u proizvodnji maline*. Monografija, Institut za ekonomiku poljoprivrede, Beograd, str. 197 [in English: Kljajić, N. (2014): *Efficiency of investments in raspberry production.* Monograph, Institute of Agricultural Economics, Belgrade, p. 197]

3. Miljković, N. (2005): *Meliorativna pedologija*. Univerzitet u Novom Sadu, Poljoprivredni fakultet, JVP "Vode Vojvodne", N. Sad, str. 550 [in English: Miljković, N. (2005): *Reclamation pedology.* University of Novi Sad, Faculty of Agriculture, JVP "Vode Vojvodne", N. Sad, p. 550]
4. Petković, S. (2003): *Strategija razvoja navodnjavanja u Srbiji*. Vodoprivreda, Vol. 35, br. 1-2, str. 50-60. [in English: Petković, S. (2003): *Irrigation development strategy in Serbia*. Vol. 35, no. 1-2, p. 50-60]
5. Potkonjak, S., Mačkić, K. (2010): *Proizvodno-ekonomski efekti navodnjavanja sa posebnim osvrtom na male površine*, Savremena poljoprivredna tehnika. Vol. 36, No.3, str. 256-266. [in English: Potkonjak, S., Mačkić, K. (2010): *Production-economic effects of irrigation with special reference to small areas*, Modern agricultural technology. Vol. 36, No.3, p. 256-266]
6. Sredojević, Z., Gajić, B. (2020): *Analiza troškova i koristi kao deo procene održivosti projekta za sanaciju zemljišta: Studija slučaja.* Knjiga sažetaka, Simpozijum – Navodnjavanje i odvodnjavanje u svetlu klimatskih promena, 9-11. Sept., Vršac, str. 17 [in English: Sredojević, Z. & Gajić, B. (2020): *Cost-Benefit Analysis as Part of a Land Remediation Project Sustainability Assessment: a Case Study.* Book of Abstracts, Symposium - Irrigation and Drainage in the Light of Climate Change, 9-11. Sept, Vršac, p. 17]
7. Sredojević, Z, Kljajić, N., Gajić, B. (2019): *Brownfield Investments as Possibility of Revitalization and Sustainability of Locations*. Economics of Agriculture, Belgrade, Year 66, No 2, pp. 589-599.
8. Stanković, B. & Vignjević-Dordević, N. (2013): *Javno-privatno partnerstvo i koncesije, kao posebni oblici stranih ulaganja u Srbiji*. Banja Luka: Časopis za ekonomiju i tžišne komunikacije, God./Vol. 3 br. 2, pp. 285-298. [in English: Stanković, B. & Vignjević-Dordević, N. (2013): *Public-private partnership and concessions, as special forms of foreign investments in Serbia*. Banja Luka: Journal of Economics and Communications, God./Vol. 3, No. 2, pp. 285-298]
9. *Strategija upravljanja vodama na teritoriji Republike Srbije do 2034 godine* ("Sl. glasnik RS", br. 3/2017) [in English: Water management strategy on the territory of the Republic of Serbia until 2034 ("Official Gazette of RS", No. 3/2017)]

10. Tolimir, M., Kresović, B., Zivotić, Lj., Dragović, S., Dragović, R., Sredojević, Z., Gajić, B. (2020): *The conversion of forestland into agricultural land without appropriate measures to conserve SOM leads to the degradation of physical and rheological soil properties*. Scientific Reports 10, 13668, https://doi.org/10.1038/s41598-020-70464-6
11. *Vodoprivredna osnova Republike Srbije*, 2001, Ministarstvo poljoprivrede, šumarstva i vodoprivrede Republika Srbija, Istitut za vodoprivredu "Jaroslav Černi" Beograd, juni 2001. [in English: *Water Management Basis of the Republic of Serbia*, 2001, Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia, Institute of Water Management "Jaroslav Černi" Belgrade, June 2001]

INTRODUCTION OF TALL GRASSES IN SERBIAN AGRICULTURAL PRODUCTION AND USING BIOMASS AS AN ALTERNATIVE FUEL

Nenad Đurić[1], Milena Mladenović Glamočlija[2], Milorad Đokić[3], Marija Spasić,[4] Đorđe Glamočlija[5]

Abstract

This research involved four perennial species belonging to the family of grasses (fam. Poaceae) characterized by intensive annual vegetative biomass growth and stalk height of above two meters. These are rush wheatgrass (Thinopyrum ponticum), switch grass (Panicum virgatum), elephant grass (Arundo donax) and miscanthus (Miscanthus × giganteus). These species originate from a large geographical area and are well adapted to various agro-ecological conditions. They are suitable for growing on soils with low natural fertility, on which most cultivated plants fail. The produced biomass (fresh or dry) is used to obtain gaseous, liquid and solid biofuels. Owing to their high tolerance to soil conditions, they are increasingly used for phytoremediation of devastated surfaces in the process of recultivation. During the vegetation season, these species incorporate significant quantities of carbon dioxide and other gases from the atmosphere. Production technology for these plants is simple and can be implemented using standard agricultural mechanization. Highest investments are required in the first year, when crops are established, with production costs significantly dropping in subsequent years. According to data from our own investigations, as well as results of other authors, costs for establishing crops amount to 4,000-4,500 EUR/ha, depending on the species. Biomass yields in the year of establishing are relatively low and do not cover production costs, but from the second or third year, high yields that justify the investment in growing these energy crops are realized. Depending on the

1 Nenad Đurić, Ph.D., Associate Professor, University of Megatrend, Faculty of Biofarming, Maršala Tita no. 39, 24300 Bačka Topola, Serbia, Phone: +381 62 80 35 360, E-mail: nenad.djuric@outlook.com

2 Milena Mladenović Glamočlija, M.Sc., Institute of Applied Sciences in Agriculture, Bulevar Despota Stefana no. 68, 11000 Belgrade, Serbia, Phone: +381 69 121 09 85, E-mail: milena.m.glamoclija@gmail.com

3 Milorad Đokić, Ph.D., Assistant Professor, University of Megatrend, Faculty of Biofarming, Maršala Tita no. 39, 24300 Bačka Topola, Serbia, Phone: +381 65 685 93 37, E-mail: milorad59@yahoo.com

4 Marija Spasić, Ph.D., Phone: +381 64 88 03 412, E-mail: mrmarija.spasic@gmail.com

5 Đorđe Glamočlija, Ph.D., Full Professor, Faculty of Agriculture, Nemanjina no. 6, 11080 Belgrade, Serbia, Phone: +381 64 171 13 23, E-mail: lami.agrif@gmail.com

species, as well as the maintaining of crops, established plants can be used for up to twenty years, which in the end fully justifies growing tall grasses for producing biofuels, but also for phytoremediation of devastated soils.

Key words: *tall grasses, agricultural production, biomass yield, alternative fuel, production costs.*

Introduction

The family of grasses (*Fam. Poaceae Barnhart*) encompasses annual and perennial species of natural and seeded lawns, forests (bamboo) and arable land. Today, grasses grow among spontaneous flora and on arable surfaces on all five continents, including the Antarctica (*Reynolds*, 2016). From the dawn of civilization, they played an important role for the human community, and for thousands of years they are grown and used for food for humans and domesticated animals.

The future significant growth of the human population will present a huge problem to discover and apply new technological solutions to produce food and energy, as well as protect the environment. Scientists predict that in 2050 utilization of food and energy will double (*Oljača et al.,* 2007). Global quantities of fossil fuels, the main source of energy, are limited. On the other hand, the constantly growing utilization of fossil fuels significantly increases quantities of harmful gasses in the atmosphere. There is a growing global interest in obtaining fuel from alternative sources. One of the directions is the use of plant mass as a renewable source of clean energy.

The global problem of availability of energy sources and concern about inevitable climate changes occurring as a result of the emission of greenhouse gases have imposed the need for more environmentally-friendly energy sources. Moreover, conventional energy sources have difficulties to match increasing demands of energy consumption (*Hashem et al*., 2013). One of the forms of renewable energy sources is biomass of energy crops. This group of field crops comprises species whose annual production of biomass per unit area can provide sufficient quantities of raw materials for obtaining biofuels.

Research to date has shown that perennial grasses are a very good raw material for obtaining bio fuels. These species have high photosynthesis activity and produce high yields of maximum efficiency biomass. Due to high annual stalk growth (over two meters), they are frequently referred to as tall grasses.

Owing to a series of positive production traits in recent decades tall grasses are becoming increasingly interesting as energy crops. Their fresh biomass serves for obtaining gaseous and liquid bio fuels, and when dry, for producing pellets and briquettes. Investigations by *Dickeduisberg et al*. (2017) have shown that by annual above ground biomass yield and obtained methane, these species can compare to maize. Investigating the application of various agro-technical measures for biomass growth, these authors conclude that in their years of full production these species are crops very good for commercial production of bio fuels. As fuels, they fully exclude the use of maize for these purposes, emphasizing that they are better adapted to unfavorable agro-ecological conditions.

While researching biological characteristics and the relationship between species and agro-ecological conditions, scientists have singled out several species of perrenial grasses as the best energy species. Following species should be emphasized: rush wheat grass (*Thinopyrum ponticum*), switch grass (*Panicum virgatum*), reed canary grass (*Phalaris arundinacea*), common reed (*Pharagimites communis*), elephant grass (*Arundo donax*) and miscanthus (*Miscanthus ×giganteus*). Work on the breeding of various wild forms of these species, has created varieties with following favorable characteristics: intensive annual above ground biomass growth, upright stalks over two meters tall that regenerate well after mowing and can be grown under different climate and soil conditions. Mentioned species develop a strong root system and perennial rhizomes deep underground that are protected against freezing and can be grown also in areas with cold winter sand longer periods of frost.

Being highly productive plants with a perennial life cycle, certain species are introduced into production in areas with a continental climate, from northern Europe and American the northern hemisphere, to Australia in the southern hemisphere. In the mentioned climate belt most species are grown on various types of soils, from sandy, loamy, to heavy clayey. They also thrive on dry as well as wet and occasionally flooded soils. They are very tolerant to the reaction of the soil solution. It is possible to grow them on acid (pH 5.5) and very alkaline soils (pH 8.5). These plants have very high photosynthetic activity and sunny positions suit them best. Water requirements are relatively low (except for reeds) and they thrive in areas with 300-750 mm of annual rainfall. During the growing season, they absorb a lot of heat and tolerate very high air temperatures (+40^{o} C), as well as frosts down to -40 ^{o}C.

There are various compression technologies to process it to solid bio fuels (bales, briquettes, pellets) for more efficient use in the production of electricity and heat (*de Vries et al.*, 2010). Apart from energy purposes, the biomass of tall grasses is being increasingly used as a raw material for making cardboard and some biodegradable products for everyday use, for building materials, as an ornamental plant, for amelioration of various areas (*Dželetović and Glamočlija*, 2011), for obtaining high-quality organic fertilizer and for biochar, which is used for repairing the physical and chemical properties and increasing the soil fertility (*Melligan et al.*, 2012).

From the group of tall grasses, four species have been singled out as the most suitable for growing under agriecological conditions in Serbia, in low lands and hilly regions. These are rush wheat grass, switch grass, elephant grass and miscanthus. According to our own research results (*Dželetovićand Glamočlija*, 2011; *Glamočlija et al.* 2012; *Djuric and Glamoclija*, 2017; *Maksimović et al*. 2019; *Mladenović, Glamočlija et al*. 2020), as well as conclusions of other authors (*Rowe et al*. 2009; *Hoque et al*. 2015), these species offer high yields of raw materials for further processing. Low investments in production and several years of utilization secure a cheap source of energy that justifies commercial production and can compete with fossil fuel prices. They have no major significance as food for humans and domesticated animals; therefore their use for obtaining bio fuels does not threaten global food quantities. It should be emphasized that agritechnics are simple, and investments in productionare minimal. Simultaneously, the growing of these plants has a favorable influence on the environment.

Results and Discussion

Based on the analysis of the most important climate data (amounts and distribution of precipitation during the vegetation period and thermal regime) and the requirements of these tall grasses it can be emphasized that environmental conditions in our most important lowland and hilly regions are very favorable (Tables 1 and 2).

Table 1. Monthly precipitation amounts in vegetative period, perennial average, (mm).

Month/Locality	Srem	Mačva	Podrinje	Šumadija	Optimum*
IV	49	55	55	48	50-70
V	66	56	68	56	70-85
VI	89	82	102	85	80-95
VII	67	63	88	63	80-90
VIII	58	55	75	57	70-80
IX	45	53	68	52	50-65
IV-IX	358	364	456	361	400-485

1. Locality –Srem (Stara Pazova), 2. Locality – Mačva (Šabac), 3. Locality – Podrinje (Loznica), 4. Locality – Šumadija (Mladenovac), * Clifton-Brown (1997)

Table 2. Temperature regime in vegetative period,perennial average, (^{o}C)

Month/Locality	Srem	Mačva	Podrinje	Šumadija	Optimum*
IV	13.6	15.2	11.1	12.1	10-15
V	18.5	18.2	16.2	17.2	15-17
VI	21.1	20.3	19.1	20.1	18-20
VII	22.8	22.2	21.4	22.4	20-24
VIII	22.7	21.1	20.2	21.2	19-23
IX	18.2	17.2	17.0	17.0	16-19
IV-IX	19.5	19.0	17.5	18.3	16.3-19.6

1. Locality –Srem (Stara Pazova), 2. Locality – Mačva (Šabac), 3. Locality – Podrinje (Loznica), 4. Locality – Šumadija (Mladenovac), * Clifton-Brown (1997)

Annual climate condition variations, especially of precipitation quantities and distribution have no effect on yields of biomass of miscanthus, a plant species subject to several years of investigations under various agro-ecological conditions (*Djuric and Glamoclija*, 2017; *Maksimović et al*., 2019; *Mladenović Glamočlija et al*., 2020). Rush wheat grass originates from semiarid areas of Eastern Europe so agro-ecological conditions of temperate continental climate are optimal for growing this species (*Dickeduisberg et al*., 2017). Switch grass grows wild in the steppes of North America. It is very tolerant of drought and to both high summer air temperatures and cold winters. Newly created varieties have these characteristics, especially forms of mountain switch grass, which allows the cultivation of these plants in a wide area of temperate to harsh continental climate (*Dale and Kim*, 2004). Giant elephant grass originates from the region from the Mediterranean to South Asia. It thrives best under conditions of warm and humid climate, but there are ecotypes that can also be grown outside these areas, because they tolerate winter frosts well (*Hardion et al*., 2014), as was also shown by our initial investigations in experiments established in Eastern Srem.

According to results of investigations related to establishing perennial high grasses, overall production technology can be implemented using standard agricultural mechanization (*Dželetović and Glamočlija*, 2011; *Maksimović et al*., 2016). Under our agriecological conditions, rush wheat grass is established in the fall (October), while elephant grass and miscanthus are planted in the spring (April). In the following year the first two species have a yield that to a large extent covers production costs, while commercial yields of elephant grass are not obtained until the third year. Total costs of establishing crops depend on the species. The average price for establishing tall wheat grasses seeds (rush wheat grass and switch grass) is715.5 to 774.5 Euro (Tables 3 and 4). Elephant grass and miscanthus are propagated exclusively from rhizomes so the average price for establishing these plants is higher, because considerable quantities of rhizomes are needed for planting (Tables 5 and 6).

Table 3. Analytical calculation for establishment a tall wheatgrass plantation

Elements	Quantity	Price, (Euro)	Value, (RSD)
Production costs			
1. Material costs			
- NPKmineral fertilizer - KAN (AN)	300 kg ha^{-1} 150 kg ha^{-1}	0.30 0.25	90 37.5
- seeds - herbicides (*Glyphosate*) - herbicides (*Florasulam*)	25 kg ha^{-1} 4 l ha^{-1} 0,5 l ha^{-1}	6.00 3.50 18	150 14 9
2. Machines			
- plowing	95		95
- disking	34		34
- soil preparation	12		12
- sowing	30		30
- top dressing - herbicide spraying	32 20 x 2		22 40
- irrigation	182		182
Total costs			**715.5**

Source: * Tall Wheatgrass (2020).

Table 4. Analytical calculation for establishment a switch grass plantation

Elements	Quantity	Price (Euro)	Value (Euro)
Production costs			
1. Material costs			
- NPK mineral fertilizer - KAN (AN)	300 kg ha^{-1} 150 kg ha^{-1}	0.30 0.25	90 37.5
- seeds - herbicides (Glyphosate)	18 kg ha^{-1} 4 l ha^{-1}	12.2 3.5	220 14
2. Machines			
- herbicide spraying - plowing	20 95		20 95
- disking	34		34
- soil preparation	20		20
- sowing	30		30
- top dressing	32		22
- irrigation	182		182
Total costs			**774.5**

Source: * Tall Wheatgrass (2020).

Table 5. Analytical calculation for forming a giant reed plantation

Elements	Quantity	Price (Euro)	Value (Euro)
Production costs			
1. Material costs			
- NPKmineral fertilizer	300 kg ha^{-1}		170
- rhizomes - herbicides (*Glyphosate*)	20,000 ha^{-1} 4 l ha^{-1}		1,250 45
2. Machines			
- tillage and planting	720		720
- irrigation	335		335
- hilling	120		120
Total costs			**2,640**

Source: Pilu et al. (2013).

Table 6. Analytical calculation for establishment a miscanthus plantation.

Elements	Quantity	Price (Euro)	Value (Euro)
Production costs			
1. Material costs			
- NPK mineral fertilizer	300 kg ha^{-1}	0.30	90
- rhizomes - herbicides (Glyphosate)	22,000 ha^{-1} 4 l ha^{-1}	0.18 3.5	3,960 14
2. Machines			
- plowing	90		90
- soil preparation	20		20
- planting	45		45
- cultivation between rows	22		22
- hilling	80		80
Total costs			**4,336**

Source: Own research (Djuric i Glamočlija, 2017).

As a raw material for obtaining fuel, produced biomass can compete with prices of fossil fuels if we opt for a technology of production that will maximally use the potential fertility of the genotype and upgrade the process for obtaining bio fuel. In addition, it should be emphasized that the production of these fuels significantly contributes to maintaining a healthy ecosystem and rural development, especially in areas with dominantly elderly households, and with increasing areas of uncultivated agricultural land, as pointed put by *Janić et al*., (2009).

Conclusions

Based on own research results and comparisons with results of other authors, following conclusions can be drawn:

- The studied four species belonging to the group of tall grasses are economically very important plants the biomass of which can be used in multiple ways;
- The best way to use produced plant biomass, but also seeds is to produce gaseous, liquid and solid bio fuels;
- To date, all four species, growing wild in a large geographical area and under various agro-ecological conditions, have been the subject of numerous investigations, so that numerous varieties have been created and the technology of production perfected;

- This research has shown that the establishing of plants and their maintaining in subsequent years can be achieved with standard agricultural mechanization;
- The perennial life cycle, as well as the possibility of growing on marginal soil sand the relatively simple technology of production, enable better utilization of overall agricultural resources;
- The produced raw material can be processed on own small homesteads in various ways, including to obtain bio fuels, because today the market offers small processing facilities;
- Large agricultural producers can more efficiently recultivate certain areas of land and secure larger quantities of raw materials for fuel that could be used in small facilities for producing electricity;
- The burning of bio fuels obtained by processing these raw materials does not increase quantities of carbon dioxide, or of other harmful gases in the atmosphere;
- Tall grasses are also very significant from the point of ecology, because these crops can be established in areas exposed to high environmental pollution (industrial plants, livestock farms, roads, cities). Simultaneously, reliance on fossil fuel imports would decrease;
- Finally, it should be emphasized that the high initial investments to establish plants, especially elephant grass and miscanthus, should be mitigated via adequate subsidies, until plants reach full yield and provides a continuous market supply of cheap and quality raw material for bio fuel production.

Literature

1. Clifton-Brown, J. C., (1997): *The importance of temperature in controlling leaf growth of Miscanthus in temperate climates*. PhD thesis, Trinity College, Dublin.
2. Dale, B. and Kim, S. (2004): *Cumulative energy and global warming impact from the production of biomass for biobased products,* (PDF). Journal of Industrial Ecology, 7 (3-4), pp. 147-162. doi:10.1162/108819803323059442.
3. Dickeduisberg,M., H. Laser,B. Tonn,J. Isselstein (2017):*Tall wheatgrass (*Agropyron elongatum*) for biogas production: Crop management more important for biomass and methane yield than grass provenance*. Industrial Crops and Products, Vol. 97, pp. 653-663.

4. Djuric, N. and Glamoclija, Dj. (2017): *Introduction of mischantus in agricultural production in Serbia and the potential for using biomass for obtaining alternative fuels*. International Scientific Conference, Suistainable agriculture and rural development in terms of the Republic of Serbia strategic goals realization within the Danube region - support programs for the improvement of agricultural and rural development, Thematic Proceedings, pp. 453-470.
5. Dželetović, Ž. and Glamočlija, Đ. (2011): *Economic importance of production of Miscanthus*. Agricultural Engineering, 36 (2), pp. 61-68.
6. Glamočlija, Đ., Janković, S. M. and Pivić, R. (2012):*Alternative Grains: Economic Importance, Growing Conditions, Species and Agricultural Practices*. Belgrade, Mladost biro DD. Zemun, 118 p.
7. Hardion, L., K. Saltonstall, R. Verlaque and A. Leriche (2014):*Origin of the invasive Arundo donax (Poaceae): A trans-Asian expedition in herbaria*. Annals of Botany, 114 (3), DOI: 10.1093/aob/mcu143
8. Hashem, M., Ali, E. H. and Abdel-Basset, R. (2013):*Recycling rice straw into biofuel "Ethanol" by Saccharomyces cerevisiae and Pichia guilliermondii*. Journal of Agricultural Science and Technology, 15, pp. 709-721.
9. Hoque, M., Artz, G. and Chad, H. (2015): *Estimated cost of establishment and production of "Liberty" switchgrass*. Iowa State University, Extension and Outreach, File A1-29, pp. 1-7.
10. Janić, T., Brkić, M., Igić, S, i Dedović, N (2009): *Gazdovanje energijom u poljoprivrednim preduzećima i gazdinstvima*. Savremena poljoprivredna tehnika, 35 (1-2), str. 127-133.
11. Lewandowski, I. and Kicherer, A. (1997): *Combustion quality of biomass: practical relevance and experiments to modify the biomass quality of Miscanthus ×giganteus*. European Journal of Agronomy, 6, pp. 163-177.
12. Maksimović, J., Pivić, R., Stanojković-Sebić, A., Vučić-Kišgeci, M., Kresović, B., Dinić, Z. and Glamočlija, Đ. (2016): *Planting density impact on weed infestation and the yield of Miscanthus grown on two soil types*. doi: 234/2016. Issue of 8/2016 PSEPlant, Soil and Environment, 62, pp.384-388**.**
13. Melligan, F., Dussan, K., Auccaise, R., Novotny, E. H., Leahy, J. J., Hayes, M. H. B. and Kwapinski, W. (2012): *Characterisation of the products from pyrolysis of residues after acid hydrolysis of Miscanthus.* Bioresource Technology, 108, pp. 258-263.

14. Mladenović Glamočlija, M., Popović, V., Janković, S., Mihailović, V., Čurović, M., Glamočlija, Đ. and Đokić,M. (2020): *Nutrition Effect to productivity of bioenergy crop Miscanthus x giganteus in different environments*. Geo Eco-Eco Agro Conference, 28-31 May, Podgorica.
15. Oljača, S, Oljača, M., Kovačević, D. i Glamočlija, Đ. (2007): *Ekološke posledice upotrebe biljaka za dobijanje energije*. Poljoprivredna tehnika, 32 (4): str. 91-97.
16. Pilu, R., Manca, A and Landoni, M. (2013): *Arundo donax as an energy crop: Pros and cons of the utilization of this perennial plant*. Maydica, 58 (1), pp. 1-6.
17. Reynolds, S. G. (2016):"*Grassland of the world*". www.fao.org

* Tall Wheatgrass (*Agropyron elongatum*) - Sharp Bros. Seed Co. Write a Review (2020). https://sharpseed.com/tall-wheatgrass/

TRADE IMBALANCE EFFECTS IN THE MEASUREMENT OF INTRA-INDUSTRY TRADE IN AGRICULTURAL PRODUCTS

Nikola Njegovan[1]

Abstract

Since the 70s when Krugman used Dixit-Stiglitz formalization of Chamberlin's monopolistic competition model to provide a theoretical explanation of intra-industry trade (IIT), many authors were encouraged to attempt to measure it. The most famous among IIT indexes is certainly Grubel-Lloyd index ($\bar{B}_i$). Although fundamental problems in measuring IIT are those of categorical aggregation, many authors were also concerned about the trade imbalance problem. Namely, $\bar{B}_i$ cannot express a maximum value when total imports and exports are not equal. Literature recognizes certain solutions to this problem (corrected $\bar{B}_i$, Aquino index), but none of them were imposed as definite. The aim of this paper is to offer an alternative solution to the problem of trade imbalance in the form of an index.

Key words: *intra-industry trade, agricultural trade, intra-industry trade indices.*

Introduction

When enough empirical data accumulates contradicting a hypothesis, attempts are made to revise the theory. This had been the case with the theory of international trade in the 1970s[2] when it was observed that the standard principle of comparative advantage is unable to cope with the existence of trade between countries with similar factor availability – two-way trade in differentiated products (products that are close but not perfect substitutes)[3], i.e. intra-industry trade (IIT) - but also the fact that trade can be conducted

1 Nikola Njegovan, Ph.D., Assistant Professor, University of Belgrade, Faculty of Economics, Kamenička street no. 6, 11000 Belgrade, Serbia, Phone: +381 69 80 66 353, E-mail: nikola.njegovan@ekof.bg.ac.rs

2 A great part of global trade can be explained by the difference in availability of inputs. In fact, every country should export products for the production of which their abundant resources are required and import those products for production of which resources required are scarce. These are the foundations of the inter-industry trade based on the theory of Bertil Ohlin (Pelević, 2006, pp. 154-155).

3 Due to the similarity of products, capital and labor are used in almost same proportions in their production. This form of trade is most pronounced between the countries with similar factor endowments (Pelević, 2006, pp. 154-155). To the best of the author's knowledge, the late Prof. Pelević was among the first to deal with this subject in our region, thus it has become an integral part of the domestic textbooks (Pelević, 2004, pp. 63-81).

between countries with similar factor endowments without causing major distributional effects.

A simple explanation of IIT lied in the assumption of increasing returns to scale. Namely, the principle of comparative advantage rests on the thesis of *inter-industry* specialization and trade. On the other hand, scale economies can result in each country producing just a subset within each group of products and thus lead to *intra-industry* specialization and trade. Moreover, when countries are similar enough (producing products with similar factor shares), the benefits of extending the market will outweigh the distributional effects (Krugman, 1981, pp. 959-961).

Unfortunately, the path to further development of the theory was not open. The general equilibrium theory rested on the assumptions of competition and homogenous products and could not cope easily with the problems that appear if scale economies are introduced into the analysis. However, in the 1970s, Dixit and Stiglitz (Dixit & Stiglitz, 1977) formulated a Chamberlinian representative consumer general equilibrium model of monopolistic competition that offered a possible solution to this problem. On the cost side, increasing returns were modeled in a standard way by means of fixed plus constant marginal costs. However, on the demand side it was necessary to solve the problem of commensurability[4] between the quantity and diversity, which was done by using a specific *CES* form of utility function where the exogenously given coefficient of elasticity of substitution (degree of similarity of products) plays a role of insatiable *love of variety*.[5] Krugman adapted this model (Krugman, 1979), (Krugman, 1981) to show that the previously stated results can be obtained following this line of reasoning. As claimed by Krugman himself, although the model depends on extremely restrictive assumptions, new progress was made possible for trade theory (Krugman, 1981, p. 971).

Considering that the new international trade theory rested on scale economies and presence of monopolistic competition, the main IIT determinants that can be singled out are:[6]

4 For more information on the issues of commensurability see: (Njegovan, 2016).

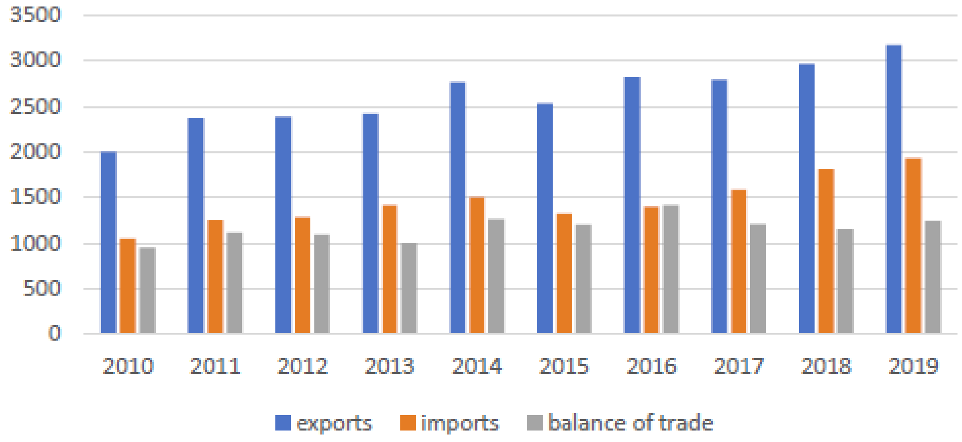
5 The utility function has the following form: $u = U\left(x_0, \{\sum_i x_i^{\rho}\}^{\frac{1}{\rho}}\right)$ where ρ has the value $(\sigma - 1)/\sigma$ and σ represents the elasticity of substitution between the variety x_i of the differentiated product, and x_0 represents the quantity of homogenous product. For more on Dixit-Stiglitz model see: (Njegovan, 2017, pp. 95-136).

6 See: (Pelević, 2004, pp. 76-77), (Milutinović, 2015, pp. 39-40), (Skuflić & Vlahinić, 2018, pp. 729-730).

- Level of country's development (demand for differentiated products is more intensive in developed countries);
- Similarity between the countries (similar GDP per capita indicates similarity in the demand structure);
- Market size (bearing in mind the significance of specialization and increasing returns, market size is of crucial importance; the importance of economic integrations is emphasized on the same principle);
- Immediate geographic vicinity (empirical studies have shown that IIT intensity is greater if the countries are bordering; there are cultural, taste and habit impacts on the similarity in demand structures; neighboring countries could also have similar resource potential);
- Transport costs (which may be linked to distance of trade partners, but also to other factors);
- Market barriers (another cost related reason).

What is more, IIT makes approximately one fourth of the world trade. It plays an important role in the trade of industrial products between the industrially developed countries. More than a half of their bilateral trade flows is intra-industry in character (Milutinović, 2015, pp. 40-41). However, considering the high presence of differentiated products in smaller economies, IIT is not negligible even in the case of smaller countries.

Figure 1. Serbian exports, imports, and balance of trade by SITC rev. 4, sections 0 and 1 (millions of dollars)



Source: Statistical Office of the Republic of Serbia, https://data.stat.gov.rs/

For a small and open economy such as the Republic of Serbia (also a developing country), with a relatively significant trade to GDP ratio, presence of a trade deficit is not surprising.[7] It is mainly caused by the fact that cheaper and higher quality inputs and technologies are imported compared to the ones the country disposes with. On the other hand, such countries are, most often, agricultural countries that raise their national competitiveness by export of agricultural and food products. Serbia is no exception in that sense. For decades now, it is oriented towards realizing a trade surplus in agricultural and food products (Figure 1).

The balance of trade in agricultural and food products has been positive for more than a decade now. Unfortunately, this was for the most part due to low value-added products (mostly primary agricultural products – livestock, meat, corn, wheat, fresh or frozen fruit, such as e.g. raspberry, sour cherry, apples; or primary processing food products – flour, sugar etc.). The most significant Serbian trade partners have been the European Union (EU) and some of its member countries, as well as the countries within the trade integration CEFTA.

Taking in the account Serbian orientation towards export promotion in agricultural and food products, it is possible to monitor the IIT intensity as one of the significant competitiveness indicators. This paper aims to provide a new framework for measuring IIT by constructing an index that addresses the trade imbalance problem in a way that differs from that used existing indices.

IIT and trade imbalance effect

This part will deal with the construction of IIT index, problems that might appear in the process, and will also present an attempt to form an alternative IIT index whereby certain deficiencies of the existing measures could be avoided.

Among the numerous indices measuring the horizontal, vertical, but also changes in IIT, the most frequently used Grubel-Lloyd's index of intra-industrial trade stands out. It was formulated back in 1971 (Grubel & Lloyd, 1971, p. 250), and measures the IIT level.[8] Its form for the industry at the given aggregation level is provided by the following formula:

7 The deficit is most frequently covered by FDI inflow and remittances which are particularly significant in the case of Serbia.

8 For a review of alternative IIT measures see: (Seecharan & Hosein, 2013, pp. 298-304).

$$B_i = \frac{[(X_i + M_i) - |X_i - M_i|]}{X_i + M_i} \cdot 100 \qquad (1)$$

where X_i and M_i denote exports and imports of the industry i respectively. In fact, from the sum of exports and imports $(X_i + M_i)$ the "non-overlapping" S_i $(S_i = |X_i - M_i|)$ is subtracted, so that the numerator represents "overlapping" i.e. total IIT. It is then divided by the sum of imports and exports to obtain the IIT share in total trade.

The sum index is formed as a weighted average of individual indexes, i.e. has the following form:

$$\bar{B}_i = \frac{\sum_i^n (X_i + M_i) - \sum_i^n |X_i - M_i|}{\sum_i^n (X_i + M_i)} \cdot 100 \qquad (2)$$

One of the main measurement problems of intra-industry trade is related to categorical aggregation of data. Namely, the more aggregated the data is, the higher is the index value. It could seem that this problem could be resolved by making a "proper" classification of products, namely, defining an industry. Unfortunately, the problem is as solvable as the problem of Chamberlin's "group" (Njegovan, 2017, pp. 15-16). For this reason, the solution must be sought preferably by more precise definitions, standardization, and disaggregation. Reflecting on the first two approaches, the most often used is the 3-digit SITC aggregation level, and it seems that this at least ensures comparability of results. The third approach relies on comparison of obtained indices values at different aggregation levels.

The literature on categorical aggregation highlights two main problems: the "opposite sign effect" and "weighting factor effect" (Greenaway & Milner, 1983, p. 901). The first appears in the case where the imbalance at lower aggregation levels has an opposite sign.[9] Only in the absence of this effect, $\bar{B}_i$ measures the weighted average of individual indices (Greenaway & Milner, 1983, pp. 901-902). Thus, the second effect depends on the consistency of the trade imbalance signs at lower levels of aggregation.

Another problem is related to the fact that the index cannot declare a maximum value when there is an imbalance in the total trade. Namely, when total imports and exports are not equal. Therefore, the same authors proposed the following adjustment (Grubel & Lloyd, 1971, p. 251):

9 For an illustrative example see: (Andersen, 2003, p. 5).

$$\bar{C}_i = \frac{\sum_i^n (X_i + M_i) - \sum_i^n |X_i - M_i|}{\sum_i^n (X_i + M_i) - |\sum_i^n X_i - \sum_i^n M_i|} \cdot 100 \qquad (3)$$

In addition to the two indices presented above we will introduce in this paper the index proposed by the author. It is based on the Grubel-Lloyd's index, but takes different weighting factors. Such index represents an alternative solution to the problem of trade imbalance. Considering that represents non-overlapping, we will classify non-overlappings subject to whether they originate from exports (S_{1i} for each i where $X_i > M_i$) or from imports (S_{2i} for each i where $M_i > X_i$). It can be shown that the Grubel-Lloyd index can alternatively be written in the form of weighted average of overlappings in exports and imports, where shares of exports and imports of a certain product in a given industry are taken as weights respectively.

$$\bar{B}_i = \frac{\sum_i^n (X_i - S_{1i})}{\sum_i^n X_i} \frac{\sum_i^n X_i}{\sum_i^n (X_i + M_i)} + \frac{\sum_i^n (M_i - S_{2i})}{\sum_i^n M_i} \frac{\sum_i^n M_i}{\sum_i^n (X_i + M_i)} \qquad (4)$$

What follows is the proposed alternative solution for the problem of trade imbalance in the form of index which suggests equal weights instead:

$$NN = \frac{\sum_i^n (X_i - S_{1i})}{\sum_i^n X_i} \cdot 0.5 + \frac{\sum_i^n (M_i - S_{2i})}{\sum_i^n M_i} \cdot 0.5 \qquad (5)$$

Finally, it can be shown that $\bar{B}_i \le NN \le \bar{C}_i$ always applies, where the equality of all three coefficients is achieved in case of a balanced trade ($\sum_i^n X_i = \sum_i^n M_i$).

Conclusion

As claimed in the report on global agriculture, two-way trade between developing countries can be a significant factor of their development as this stimulates scale economies, i.e. enables domestic producers to sell products that are "homogenous with respect to factor requirements, but heterogeneous with respect to utilization and marketing to both domestic and foreign markets" (Bruinsma, 2003, pp. 291-293). Consideration of IIT facilitates expressing numerous hypotheses that could undergo empirical testing. It could be possible to test whether trade barriers and trade agreements have the anticipated impact on the IIT level by comparing the levels before and after lifting of certain trade barriers or prior to and after entering a trade agreement (*CEFTA*). Furthermore, it could be tested whether there is a correlation between increase in trade surplus in agricultural products and increase of IIT. Moreover, it seems that the low IIT level between the two countries can also give certain support to the argument against small farm estates. However, the aim of this paper was primarily of methodological nature. It is about the construction of an IIT index that provides a new way to address the trade imbalance problem - an alternative to the adjusted Grubel-Lloyd index. Still, a lot of empirical work remains to be done in terms of comparing the performance of the index to other IIT indices, which could provide new insights in terms of Serbian agricultural trade with some of the major trade partners.

Literature

1. Andersen, M. A. (2003): *Empirical intra-industry trade: what we know and what we need to know.* Retrieved 3 29, 2018, from Vancouver: University of British Columbia: http://www.sfu.ca/~andresen/papers/Empirical_IIT_Lit_Review.pdf
2. Bruinsma, J. (2003): *World Agriculture: Towards 2015/2030 AN FAO Perspective.* Food and Agriculture Organization (FAO). London: Earthscan Publications Ltd.
3. Dixit, A. K., & Stiglitz, J. E. (1977): Monopolistic Competition and Optimum Product Diversity. *The American Economic Review, 67*(3), 297-308.
4. Greenaway, D., & Milner, C. (1983): On the Measurement of Intra-Industry Trade. *The Economic Journal, 93*(372), 900-908.
5. Grubel, H. G., & Lloyd, P. J. (1971): The Empirical Measurement of Intra-Industry Trade. In P. J. Lloyd, & H. G. Grubel (Eds.), *Intra-Industry trade* (Vol. The International Library of Critical Writings in Economics, pp. 247-270). Cheltenham, UK: Edward Elgar Publishing Limited.
6. Krugman, P. R. (1979): Increasing Returns, Monopolistic Competition, and International Trade. In P. J. Lloyd, & H. G. Grubel (Eds.), *Intra-Industry trade* (Vol. The International Library of Critical Writings in Economics, pp. 71-81). Cheltenham, UK: Edward Elgrar Publishing Limited.
7. Krugman, P. R. (1981): Intraindustry Specialization and the Gains from Trade. *Journal of Political Economy, 89*(5), 959-973.
8. Milutinović, S. (2015): Značaj intra-industrijske trgovine u savremenoj svetskoj privredi. *Ekonomija - teorija i praksa, 1*, 35-46.

9. Njegovan, N. Z. (2016): Ponovo o “Proporcionalnosti deljivosti i prinosima na obim”. In A. Živković, D. Molnar, & M. Koprivica, *Tematski zbornik radova: Ekonomska politika i razvoj* (pp. 187-199). Beograd: Univerzitet u Beogradu, Ekonomski fakultet.
10. Njegovan, N. Z. (2017): *Ograničena racionalnost u teoriji monopolističke konkurencije (doktorska disertacija).* Beograd: Univerzitet u Beogradu, Ekonomski fakultet.
11. Pelević, B. (2004): *Uvod u međunarodnu ekonomiju.* Beograd: Univerzitet u Beogradu, Ekonomski fakultet.
12. Pelević, B. (2006): Autentični neoklasičar Bertil Olin. *Economic Annals, 170*, 147-161.
13. Seecharan, R., & Hosein, R. (2013): Intra Industry Trade Measurement: Then and Now - Towards A New Measure of Marginal Intra Industry Trade. *International Journal of Business and Social Science, 4*(8), 290-307.
14. Skuflić, L., & Vlahinić, N. (2018): Koliko je hrvatska robna razmjena intra-industrijska? *Ekonomski pregled, 55*(9-10), 727-751.

DIGITALIZATION OF RURAL AREAS AND PRECISION AGRICULTURE

Petar Veselinović[1]*, Lela Ristić*[2]*, Danijela Despotović*[3]

Abstract

The implementation of information and communication technologies (ICTs) is gaining a significant impetus in modern environment. Thus, the ICTs have found their place in the development of agriculture and rural areas. Technological innovations, such as the application of sensors, robots, drones and business process automation, are increasingly being implemented in agricultural practice and the organization of life and work in rural communities in many countries. However, there are certain limitations in boosting the introduction of modern ICTs, despite the fact that their application in agriculture and rural economy brings numerous economic and non-economic benefits. Accordingly, the subject of research in this paper is the importance of digitalization of rural areas and development of precision agriculture. The aim of the research is to point to the advantages of this approach to the development of agriculture and rural communities, as well as the possibilities of its application in practice. The results of the research conducted in this paper indicate the multifaceted importance of introducing technological innovations in the agricultural sector and rural life, both in terms of the local population and the rural economy as a whole.

Key words: *technological innovations, rural development, precision agriculture, digitalization, smart villages.*

Introduction

Digitization of rural areas and development of precision agriculture in modern environment are emphasized for several reasons (economic, demographic, environmental, etc.). In parallel, some authors have identified a growing interest in

1 Petar Veselinović, Ph.D., Full Professor, University of Kragujevac, Faculty of Economics, Liceja Kneževine Srbije no. 3, 34000 Kragujevac, Serbia, Phone: +381 034 303 502, E-mail: pveselinovic@kg.ac.rs

2 Lela Ristić, Ph.D., Full Professor, University of Kragujevac, Faculty of Economics, Liceja Kneževine Srbije no. 3, 34000 Kragujevac, Serbia, Phone: +381 034 303 552, E-mail: lristic@kg.ac.rs

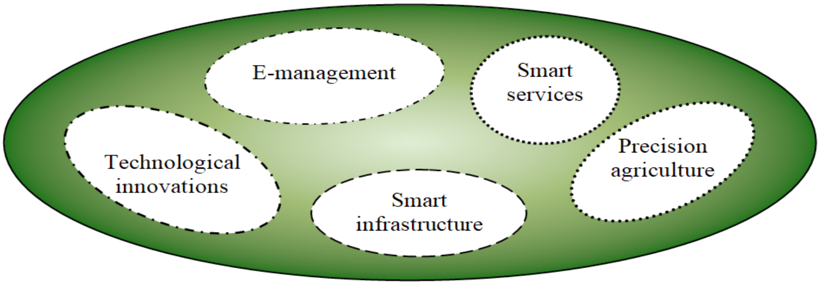
3 Danijela Despotović, Ph.D., Full Professor, University of Kragujevac, Faculty of Economics, Liceja Kneževine Srbije no. 3, 34000 Kragujevac, Serbia, Phone: +381 034 303 574, E-mail: ddespotovic@kg.ac.rs

this area (Jeremić & Brankov, 2020; Bramley & Ouzman, 2019; Herrmann et al., 2019; Visvizi et al., 2019; Ristić & Barbarić, 2019; Despotović et al., 2019; Veselinović & Veselinović, 2019; Haider et al., 2018; Yang et al., 2018; Raju et al., 2016; Bright et al., 2016; Hameed, et al., 2016; Kaur, 2016; Butler et al., 2006). Considering that the application of technological innovations in agriculture and rural development is gaining significant attention by both the theoretical framework and practice in many countries, the subject of research in this paper is the importance of digitalization of rural areas and development of precision agriculture. The aim of the research is to accentuate the advantages of this approach to the development of agriculture and rural communities, as well as the possibilities of its application. The hypothesis the paper builds upon is that the digitalization of rural areas and agriculture, in modern environment, should be further stepped up, in line with the particular features of an area, as well as the agriculture as an economic activity of the rural economy. The character of the research in this paper required the application of methods of description, comparison and content analysis, greatly relying on the theoretical frameworks in this field, as well as the examples of good practice, which have been documented around the world.

Digitalization of rural areas

Digitization of rural areas implies ICT-based development of rural areas, i.e., it focuses on the use of digital technology and information. In the process of introducing smart technology and innovation in rural development the following elements stand out: smart institutions; development of smart infrastructure, broadband networks in rural areas and functional links between villages and cities via adequate Internet access; development of mobile networks and other communication technologies; smart services; digital platforms for e-government, e-health, e-banking, e-literacy services and etc.; achieving greater mobility of the local population; better organization of rural settlements; as well as precision agriculture.

Figure 1. Digitization of rural areas



Source: Authors research.

It goes without saying that the process of digitalization of rural areas must be supported by appropriate social innovations, demographic revitalization of rural areas, development of new business models, smart specialization and diversification of the rural economy, in line with the principles of sustainable development. Modern marketing and management at all levels, public-private partnerships and local initiatives are of particular importance, as well as an appropriate mix of the "bottom-up" and "top-down" approach, including adequate planning of actions aimed at achieving the digital transformation of rural areas.

At the global level, and especially in the European Union (EU) and India, the development of "smart villages" is being promoted, heavily relying on the application of ICT in agriculture and everyday rural life and supported by broadband networks, adequate connections among villages and nearby cities, as well as appropriate socio-ecological innovations, which are in line with the needs of the local population and the environment, including taking care of human health and rational use of available natural resources.

As a part of the process of digitalization of rural areas, precision agriculture stands out, since agriculture is an activity that takes place exclusively in rural areas.

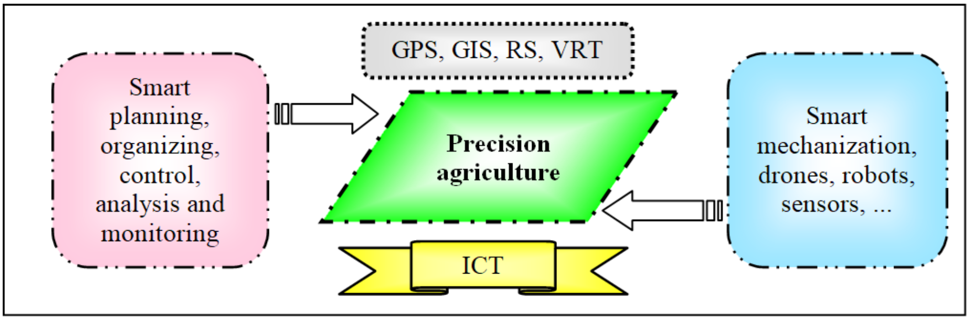
Precision agriculture

The application of ICTs in modern agricultural practice is constantly growing. At the same time, online and on-land activities are increasingly implemented, lasers are used, as well as mobile robotic devices - remote controlled devices (e.g. robots for milking cows, keeping cattle, sowing, fertilizing, harvesting, picking and counting fruits, checking plant health and animals, etc.), while drones and other unmanned aerial vehicles are used for aerial surveillance, crop mapping and detection of persons approaching the property. Satellite navigation and tracking of agricultural machinery, automatic control of agricultural equipment, 3-D scanning of plots and other similar activities are performed. Namely, ICT-based precision agriculture is being developed, including the following elements (Gvozdenac, 2017):

- Global Positioning System (GPS) - navigation system, which allows the information collected in agriculture to be used for precise determination of the position of machinery and equipment, exact needs for raw materials for each specific location, in contrast to general information on the total arable area provided by other less sophisticated methods and etc.;

- Geographic Information Systems (GIS) - allows farmers to plan their production based on timely information, obtained directly from arable land surfaces;
- Remote Sensing (RS) - allows the acquiring of information from a distance using the appropriate devices, sensors mounted on agricultural machinery, from satellites and etc.;
- Variable Rate Technology (VRT) - allows application of adequate input quantities in line with the needs of a specific agricultural area.

Figure 2. Precision agriculture



Source: Authors research.

In order for precision agriculture to be successful, it is necessary to meet certain prerequisites, i.e. to provide: adequate software solutions, knowledge and staffing; appropriate training of farmers to use the necessary applications; digitized land registries (cadasters); larger farms; suitable natural conditions; large investments; appropriate production structure and the like.

Conclusion

The research conducted in this paper, primarily relying on contemporary theory and examples of good practice around the world in the field of digitalization of rural areas and development of precision agriculture, points to the great importance of introducing modern ICTs in the agricultural sector and the process of rural community development, thus confirming the hypothesis the paper builds upon. However, it must be pointed out that the digitalization of villages and agriculture is not possible in all rural areas and in all agricultural farms or companies, as well as that there is no universal model for the application of technological innovations in agriculture and rural areas. Namely, each rural area and each economic entity in agriculture has its own specific features which must be taken into consideration and accordingly analyzed in detail, which requires comprehensive preliminary calculations that will clearly and without doubt indicate whether the introduction of ICTs is profitable and to what extent certain technologies should be implemented, as well as whether building digital local communities, i.e., rural economy and its agricultural production represents a sustainable solution.

Literature

1. Bramley, R. G. V., Ouzman, J. (2019): *Farmer attitudes to the use of sensors and automation in fertilizer decision-making: nitrogen fertilization in the Australian grains sector*, Precision Agriculture, 20(1), pp. 157–175.
2. Bright, L. Z., Handley, M., Chien, I., Curi, S., Brownworth, L. A., D'hers, S., Bernier, U. R., Gurman, P., Elman, N. M. (2016): *Analytical models integrated with satellite images for optimized pest management,* Precision Agriculture, 17(5), pp. 628–636.
3. Butler, Z., Corke, P., Peterson, R., Rus, D. (2006) *From Robots to Animals: Virtual Fences for Controlling Cattle,* The International Journal of Robotics Research, 25(5-6), pp. 485-508.
4. Despotović, D., Ristić, L., Dimitrijević, M. (2019): *Significance of Innovation for Sustainable Economic and Agricultural Development in the Republic of Serbia,* Facta Universitatis, Series: Economics and Organization, 16(4), pp. 389-401.
5. Gvozdenac, S. (2017): *Precizna poljoprivreda u sektoru zaštite bilja,* Primena informacionih tehnologija u poljoprivredi, Agronomski fakultet Univerziteta u Kragujevcu, Čačak.
6. Haider, M. F., Siddique, A. R., Alam, S. (2018): *An aproach to implement Free space optical (FSO) technology for smart village energy autonomous systems,* Far East Journal of Electronics and Communications, 18(3), pp. 439-456.
7. Hameed, I. A., La Cour-Harbo, A., Osen, O. L. (2016): *Side-to-side 3D coverage path planning approach for* agricultural robots *to minimize skip/overlap areas between swaths,* Robotics and Autonomous Systems, 76, pp. 36-45.
8. Herrmann, I., Bdolach, E., Montekyo, Y., Rachmilevitch, S., Townsend, P. A., Arnon Karnieli, A. (2019): *Assessment of maize yield and phenology by drone-mounted superspectral camera,* Precision Agriculture, 21(1), pp. 51-76.

9. Jeremić, M., Brankov, T. (2020): *The blockchain technology in agriculture,* In (Eds): Jonel Subić, Marko Jeločnik, & Jean Vasile Andrei, "Sustainable agriculture and rural development in terms of the Republic of Serbia strategic goals realization within the Danube Region - Science and practice in the service of agriculture", (pp. 357-371), Institute of Agricultural Economics, Belgrade.
10. Kaur, K. (2016): *The idea of Smart villages based on Internet of Things (IoT),* International Research Journal of Engineering and Technology (IRJET), 3(5), pp. 165-168.
11. Raju, S. V., Anwar, S., Deepika, M., (2016): *Smart villages builds smarter India,* International Research Journal of Computer Science, 12(3), pp. 48-50.
12. Ristić, L., Barbarić, Ž. (2019): *Pametna sela: budućnost održivog ruralnog razvoja*, Univerzitet u Kragujevcu - Ekonomski fakultet, Kragujevac.
13. Veselinović, P., Veselinović, N. (2019): *Agriculture in the sustainable development function of the Republic of Serbia*, 9th International Symposium on Natural Resources Management, Megatrend University, Belgrade - Faculty of Management, Zajecar, pp. 137-146.
14. Visvizi, A., Lytrasand, M. D., Mudri, G. (2019): *Smart villages in the EU and beyond,* Emerald, UK.
15. Yang, S., Yang, X., Mo, J. (2018): *The application of unmanned aircraft systems to plant protection in China,* Precision Agriculture, 19(2), pp. 278–292.

ANALYSIS OF THE MAIN INDICATORS OF FOOD CONSUMPTION, COMPARISON BETWEEN THE PERIODS 2006-2012 AND 2013-2018

Petruța Turek Rahoveanu [1]

Abstract

Romania is a country that over a long period of time has faced political, financial and even religious restrictions that have affected the consumption of agri-food products. With Romania's integration into the European Union in recent years, the phenomenon of liberalization of the agri-food market, successive increase in income scarring, and facilitated access to products have had a positive effect on the consumption of many products.

The analysis carried out shows a change in Romanian consumption, with the decrease owing not only to the increase in prices but to the domestic production as well. At the same time, there was significant decrease in the annual consumption of wheat and maize, sugar and sugar products, meat and beverages. Although the decrease in annual sugar consumption is not a concern, the decreases in meat consumption draws attention, particularly in the category of bovine meat, an assortment of products with a higher price and a much lower production over the last 20 years.

Technical, statistical and economic indicators were used in the work at both analytical and synthetic levels.

Key words: *food consumption, annual growth rate, coefficient of variation.*

Introduction

The inhabitants of Romania, regardless of their social or economic status, are entitled to fresh, healthy and sufficient products.

Agriculture has over time transformed from a local agrarian system into a global system, with imports, exports and transport large enough to cross oceans and continents every day.

1 Petruța Turek Rahoveanu, M.Sc., Scientific researcher III, Research Institute for Agriculture Economy and Rural Development (ICEADR), district 1, Marasti Blvd no. 61, 011464 Bucharest, Romania, E-mail: turek.petruța@iceadr.ro

Our country, like many other countries, once produced most of its food products domestically, but as tastes evolved, transport became cheaper, markets liberalized, more food started to come from abroad.

Supporting food independence thinking is about increasing food at the local level, not only to reduce the distance between foods, but also to eliminate dependence on large producers, transport companies and the cost of fuel.

Determining food independence is complex. A country like Romania could only source its food internally but there are products they buy from abroad because of the lack of processing units or because they are cheaper. So self-sufficiency is limited to whether a country could feed its people its own production, not whether it is indeed independent.

One of the main problems facing the Romanian agri-food system, which we have identified in the analysis undertaken, is that of massive imports of finished products while exportises are focused on raw materials.

We have also been able to identify that the agri-food system is under increased stress, the growing demand for food has led to an implementation of the intensive farming system, with serious repercussions on climate, biodiversity and, more broadly, human health, soil depletion and animal welfare. These growing systemic pressures have led to growing doubts about the sustainability of the current agricultural regime and calls for a move to a more sustainable agricultural practice.

The issue of a country's food security has continued to concern and concern, being the main themes in many studies, official strategies and specialized work in many countries in Europe and globally.

Material and method

This paper is based on statistical data and an analysis of the average annual consumption per inhabitant of foods "grains and legumes", "animal" and "drinks". Statistical indicators were used in the paper: mean, mean square deviation, standard deviation; the method of comparison; method of synthesis and interpretation.

In assessing the indicators that characterize food security, statistically, the following indicators were used: average, standard deviation, coefficient of variation, confidence limits for a given probability, trend equations and production functions (Ceoopiu, 1968), rendered by the following formula

Fixed-base indices $I_{SC} = (SC_n/SC_0)*100$

Annual growth rate = r2006-2018 = $\sqrt[9]{\pi\left(\frac{p1}{p0}\right) - 1}$,where:r2009-2017 = average growth rate;

$\prod p1/po$ = chain-based indices

For the arithmetic mean $\bar{x} = \frac{\sum xi}{n}$, in which:

X = moving arithmetic mean; Xi = average production values over a number of years (i);

n = number of years taken into account.

For standard deviation $\partial = \sqrt{\frac{\sum(\bar{x} - xi)^{\wedge}2}{n-1}}$; in which:

∂ = standard deviation; xi = average production values over a number of years; n = number of years taken into account.

For the mean square deviation $\partial x = \sqrt{\frac{\sum(\bar{x} - xi)^{\wedge}2}{n(n-1)}}$; in which:

∂x = mean square deviation;

For the coefficient of variation = , in which:

C = coefficient of variation (expressed as a percentage).

The significance of the coefficient of variation with small variation for C(%)>10; with medium variation for C(%) > 10 but < 20 and with a large variation for C(%)> 20. The resulting differences between the averages of the two periods were tested with the "t" test for a 95% probability, depending on the number of degrees of freedom.

The comparison method was used in the analysis of data series that covered time periods between 2006 and 2018, based on the available data. As this period is quite large we divided it into two: 2006-2012 and 2013-2018. For each period, the indicators were calculated: minimum value, maximum value, average, standard deviation, coefficient of variation and annual growth rate. The data obtained for the two periods were compared by the differences between the averages and growth rates of the technical-economic phenomena analysed and the statistical evaluation of these differences for probabilities of 95%, 99% and 99.9%.

Consumptions of agri-food products per capita were analysed by technical, statistical and nutritional indicators, as stand-alone elements, but also as elements of the agri-food balance of the product concerned.

In Romania, the freedom of consumers to meet the needs that define modern man in today's European society was greatly limited, both before 1989 and in the years that followed, due to the relatively low level of income, the priority of some expenditure, the limitation of the supply of goods and services on the market, and of course, due to the normal tendency to meet the growing basic food needs at an increasing level. In the transition years due to successive waves of population impoverishment, certain phenomena of exclusion from the consumption of basic goods and services of large categories of consumers were manifested (Stanciu, 2004).

Evolution of average annual food consumption

The evolution of average annual consumption per capita was analysed in the main food categories, compared to the average of the period 2006-2012 and 2013-2018 (Table 1).

Table 1. Analysis of average annual consumption per inhabitant of food products of plant origin compared between 2006-2012 and 2013-2018.

Nr crt	Main food and drink	UM	Period 2006-2012 (P1)			Period 2013-2018 (P2)			Deviation	
			Media (M1)	coefficient of variation %	Annual growth rate (R1)	Media (M2)	coefficient of variation %	Annual growth rate (R2)	M2-M1 semnif	R2-R1
1	Cereals and cereal products in grain equivalent	kg	212.6	1.33	0.06	209.72	2.16	-0.65	-2.84 θ θ	-0.71
2	Wheat, rye in grain equivalent	kg	172.5	1.57	-0.04	163.92	2.43	-0.77	-8.55θ θ	-0.73
3	Corn in grain equivalent	kg	36.0	5.07	1.21	41.02	3.33	-0.51	5.02**	-1.72
4	Potatoes	kg	101.8	2.80	0.37	98.28	3.12	-0.78	-3.50 θ θ	-1.15
5	Legumes berry	kg	3.2	10.23	3.14	3.03	23.37	-1.39	-0.20	-4.54
6	Vegetables and vegetable products in fresh vegetable equivalent	kg	155.2	3.43	-0.31	159.98	4.63	0.86	4.83**	1.17
7	Fruit and fruit products in fresh fruit equivalent	kg	71.8	8.86	-2.32	90.77	14.52	3.53	18.92***	5.86
8	Sugar and sugar products in sugar equivalent (including honey)	kg	24.8	9.63	-2.46	24.03	9.47	2.19	-0.74	4.66

Source: Processed by: INS, TEMPO - HOME, NIVEL DE TRAI: CLV104A; Semnif (GL=11, tcal > t: >0.05 *;>0,01**; >0,001***; <0.05θ ;<0,01θ θ; <0,001θ θ θ)

As regards the category of plant products, the differences in averages are negative for cereals and cereal, wheat and rye products, which means a significant decrease in the per capita food consumption of cereals, with the average period 2006-2012 being 212.6 kg/cap.

Corn is obsessed with an increasing trend in the second average period representing 41.02 kg/cap. Decreases can also be seen in the consumption of potatoes, legumes, vegetables, whose growth rates, although they are in some negative categories in the second period, the comparison of averages shows higher consumption between 2013-2018.

Vegetables and fruits have constant increases in the first period, 155.1 kg/dweller and 71.8 kg/resident respectively effect of increased availability on the market, income growth and numerous studies demonstrating their beneficial effects on health. In the second period we can see a decreasing trend of 137.6 kg/ inhabitant and 79 kg/inhabitant respectively.

Differences are also observed between distinctly significant averages to total cereals and significant for wheat, potatoes, legumes and vegetables.

Table 2. Analysis of average annual consumption per inhabitant of “animal” foods, compared between 2006-2012 and 2013-2018.

No	Main food and drink	UM	Period 2006-2012 (P1)			Period 2013-2018 (P2)			Deviation	
			Media (M1)	coefficient of variation %	Annual growth rate (R1)	Media (M2)	coefficient of variation %	Annual growth rate (R2)	M2-M1 semnif	R2-R1
1	Meat and meat products in fresh meat equivalent	kg	62.2	5.0	-0.8	63.88	11.04	2.71	1.73	3.55
2	Cattle meat	kg	7.1	1.8	-4.5	5.53	10.27	1.37	-1.55	5.90
3	Swine meat	kg	32.4	1.9	0.1	32.78	11.54	2.01	0.38	1.87
4	Bird meat	kg	19.9	2.0	-1.3	22.75	15.01	4.47	2.86	5.77
5	Vegetable and animal fats (gross weight)	kg	19.7	1.4	0.1	20.87	7.11	2.40	1.14	2.31
6	Milk and milk products in milk equivalent 3.5% fat (excluding butter)	kg	255.6	12.5	-0.2	251.67	1.78	0.48	-3.92	0.67
7	Eggs	Buc	265.1	14.5	-0.9	252.17	4.52	0.35	-12.98	1.22
8	Fish and fish products in fresh fish equivalent	kg	4.4	0.5	-0.9	5.60	15.93	4.50	1.19	5.39

Source: Processed by: INS, TEMPO - HOME, NIVEL DE TRAI: CLV104A; Semnif (GL=11, tcal > t: >0.05 *;>0,01**; >0,001***; <0.05θ ;<0,01θ θ; <0,001θ θ θ)

The consumption of products of animal origin, according to the data in Table 2, significant increases are deducted in the period 2006-2012 in all product categories, with annual growth rates. The average of the first period shows us a consumption of meat recording 62.2 kg/dweller, beef 7.1 kg/dweller, pigs 32.4 kg/dweller, poultry meat19.9 kg/dweller and eggs 26514 pieces/inhabitant.

For all meat categories the per capita consumption in Romania is well below the European average, Faostat statistics indicate a consumption more than 20% lower. However, in all product categories, there are large differences between the consumption between the two periods, the coefficient of variation being at the minimum level.

The second period is distinguished by the consumption of products with close quantities per year, the coefficient of variation being small and only for bovine and fish meat products the variation being medium.

Looking at the difference between the mean of the second period and the initial period, there is a decrease in the consumption of total meat and bovine meat and increases in animal fats, milk and fish, the differences being distinctly significant or insignificant.

Table 3. Analysis of average annual consumption per capita for food “drinks”, for the period 2006-2018.

No.	Main food and drink	UM	Period 2006-2012 (P1)			Period 2013-2018 (P2)			Deviation	
			Media (M1)	coefficient of variation %	Annual growth rate (R1)	Media (M2)	coefficient of variation %	Annual growth rate (R2)	M2-M1 semnif	R2-R1
1	Wine and wine products	Litres	22.8	7.7	0.8	21.2	10.44	-0.43	-1.62	-1.25
2	Beer	Litres	87.8	7.5	1.4	87.6	3.34	0.16	-0.18	-1.25
3	Non-alcoholic beverages	Litres	154.7	7.1	1.8	183.1	14.16	2.89	28.42	1.09

Source: prelucrat după: INS, TEMPO - HOME, NIVEL DE TRAI: CLV104A; Semnif (GL=11, tcal > t: >0.05 *;>0,01**; >0,001***;<0.05 θ ;<0,01 θ θ; <0,001θ θ θ)

As regards the consumption of wine and wine products, according to the data presented in Table 3, there is a decrease, but the differences between the averages of the two periods are very small, 1,6 kg/ inhabitant.

Very significant differences are between the averages of periods for non-alcoholic beverages, +28.4 liters with an annual rate of -1.09%.

Conclusions

Ensuring food needs in food and food security is increasingly difficult to reach, and on areas that are becoming more extensive by the day. The exception to these problems does not make Romania, which faces weak, underdeveloped links of the agri-food system, since the country's agricultural potential is ranked among the top countries in the European Union.

The evolution of the agrarian market in Romania is influenced by a number of factors, among which:

- domestic production – which determines the size of the supply of agricultural products and food on the market and, by implication, the possibility of fully satisfying the demand for consumption;.
- inputs of agricultural products and foodstuffs – under the conditions of our country, the importance of this factor can be diminished due to the fact that, with the exception of crops that do not find favorable conditions in our country, other agricultural and food products can be ensured in the situation of optimal insurance of the factors contributing to obtaining domestic agricultural production;
- the level of income of the population – which can influence the dimensions of the agrarian market by means of demand for products which may have an increasing or decreasing trend;
- the size of the prices of agricultural and agri-food products – which has an influence on the purchasing power of the population.

In recent years there has been an increase in average annual consumption of some products of vegetable origin with a high share in the diet of the Romanian population to: vegetables and fruits and cereals and products from cereals, potatoes, sugar and sugar products, vegetable fats there has been a sub-stationary decrease. As regards the consumption of products of animal origin, both increases and decreases in the basic components (meat, meat and offal products, milk and milk products;-eggs, fish and fish products) are recorded.

Literature

1. Ceopoiu, N., 1968, Applied statistical methods in agricultural experiments and statistical Ed.Agro-Silva, Bucharest
2. EUROSTART,http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do, accessed 10.11.2020.
3. INS, online tempo data http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table accessed 10.11.2020.
4. ASAS, (2013), Research-Development and Innovation Strategy in Agriculture and Rural Development for the period 2014-2020,
5. Bazga B.& Chelmu S.S., (2013),Food security,Agricultural potential, component of Romania's national security

Internet sources

6. http://www.asas.ro/Strategia%20de%20cercetare%20ASAS%202014-2020%20NOV%2015%202011.pdf
7. http://intelligence.sri.ro/securitatea-alimentara-potentialul-agricol-componenta-securitatii-nationale-romaniei/

CONDITION FOR SUSTAINABLE DEVELOPMENT OF RURAL TOURISM IN THE AREA OF LOWER DANUBE REGION IN THE REPUBLIC OF SERBIA

Predrag Vuković[1], Slavica Arsić[2], Vlado Kovačević[3]

Abstract

Six municipalities make area of the Lower Danube Region (Veliko Gradište, Golubac, Kučevo, Majdanpek, Kladovo and Negotin). The area has three main tourist attractions: the Danube River (European Corridor VII); Djerdap National Park with Djerdap Gorge; and the Archaeological Site "Lepenski vir". In addition to these, there are numerous other potential tourist attractions in the Lower Danube region. This is important for the development of rural tourism, since visits to these attractions could enrich the content of the tourist products that would be offered to tourists who would stay in one of the local rural tourist destinations in this area. The development of rural tourism is not evenly represented in this area. Majdanpek, Negotin and Kladovo stand out as municipalities with the most developed rural tourism. In addition to the existing ones which are already being used in touristic exploitation, the aim of the article is to point out the resources, on which rural tourism on principles of sustainability, could be developing in the entire area. Both receptive and all other resources that are important for the creation of rural tourist products will be pointed out.

Key words: *tourism, rural area, destination, accommodation.*

Introduction

Rural tourism has started to develop in Serbia since seventies of twentieth century. Today, it has different intesity, form and character. Achieved level of developing depends of vaious factors: „natural-geographical characteristics of the local area, the degree of development of the local economy, the anthropotics heritage and the awareness of the local population about its importance for development of the local communities". (*Vuković, P.,* 2017, p.58). In the Lower Danube region, rural tourism has developed spontaneously so

1 Predrag Vuković, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina no. 15, 11060 Belgrade, Serbia, Phone: +381 11 69 72 852, E-mail: predrag_v@iep.bg.ac.rs

2 Slavica Arsić, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina no. 15, 11060 Belgrade, Serbia, Phone: +381 11 69 72 852, E-mail: slavica_a@iep.bg.ac.rs

3 Vlado Kovačević, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina no. 15, 11060 Belgrade, Serbia, Phone: +381 11 69 72 858, E-mail: kovacevic_vlado@yahoo.com

far. There was no clear plan and strategy for its development. Regarding to accommodation capacities, they have developed mainly in the villages that were located near the main tourist attractions. These are villages located in the municipalities of Majdanpek, Negotin and Kladovo.

Accommodation capacities of rural tourism in the area of the Lower Danube region

Until now data on accommodation capacities of rural tourism in the Lower Danube region were provided by the Tourist Organization of Serbia 2018 and the National Association "Rural Tourism of Serbia" 2019 who is a member of the European Federation of Rural Tourism (EUROGITES). According to these sources, accommodation facilities are located:

1) in the municipality of Majdanpek in the villages of Rudna Glava, Mišin Breg, Crnajka;
2) in the municipality of Negotin in the villages of Vratina, Mihajlovo Kovilovo, Sharkamen, Rogljevo, Plavna, Rajac, Bukovo, Jabukovac, Vidrovac, Braćevac and Kusjak;
3) and in the municipality of Kladovo in the villages of Velika Vrbica, Korbovo and Recica.

Bearing in mind that accommodation capacities are an indicator that shows the attendance of a tourist destination, they can also be used as an indicator for the existence of local tourist destinations in which rural tourism has developed so far. According to the definition of the World Tourism Organization (UNWTO, 2007, p.1), „a local tourist destination is a physical space where tourists stay at least one night and includes tourist products, such as support services, attractions and tourist resources, used in travel". According also to the definition of the World Tourism Organization (UNWTO, 2007, p.1), „a local tourist destination is a physical space where tourists stay at least one night and include tourist products, such as support services, attractions and tourist resources, used in travel. A local tourist destination has physical and administrative boundaries that define its management, as well as the image and perceptions that define its market competitiveness". Local tourism organizations include a variety of interest groups, often including the local community, and can come together to form larger tourism destinations.

In the case of rural tourism, local tourist destinations can be defined as rural tourist destinations. Based on available secondary data sources (Đurović, D. and

Cvejić 2011; Tourism Development Strategy 2016-2025; data from the local tourist organizations, etc.) and facts:

- that in 18 villages in the area of the Lower Danube, the owners of rural farms have decided to engage in rural tourism;
- that these are sporadic cases of engaging in rural tourism (where only one, up to two households, decided to engage in this activity);

it can be concluded:

- that rural tourism is in the initial stage of development in this area;
- that in the period 2016 - 2019 there was an increase in the number of rural farms that decided to engage in rural tourism;
- rural tourism has developed spontaneously so far, without an appropriate strategy and development plan;
- In order for rural tourism to enter in a higher stage of development, investments are needed, both by the state (direct investments or through subsidies to rural households), and by private entrepreneurs who would recognize the interest in the development of rural tourism.

Traffic infrastructure as important condition for development rural tourism

Rural tourism practically began to develop after World War II after the rapid development of the automobile industry ie. with the development of road traffic, rural tourist destinations have become accessible to a large number of tourists from cities (Lane, B. 1994, p.8). Tourists in rural tourist destinations are very dependent on road traffic. Rural tourist attractions are usually spatially diffusely located and many of them are difficult to reach. Some attractions for which there is an increased tourist interest, can be "congested" with cars, and as an important problem is the construction of appropriate parking space, which disrupts the ambience of the rural area. This is important, having in mind the prerogatives on which rural tourism is based, that its development must not be to the detriment of the local environment.

The level of development of each traffic system, and thus the traffic system in the region of the Lower Danube is conditioned by:

- **The level of development of the overall economy -** in the area of the Lower Danube, according to all macroeconomic indicators observed in the six municipalities that make it up, is more limiting than a factor of development, which must necessarily be changed by investing in economic development, opening new plants and jobs. This is a precondition not only for the development of the traffic system, but for the entire economy of the area. As tourism is an integral part of the economic system, it is also a prerequisite for the development of tourism;

- **Natural-geographical position and degree of involvement in the international division of labor** - For the area of the Lower Danube from the aspect of traffic and its area, we can state that it has a favorable geographical position. The position is supported by the fact that the area in the north is bordered by the Danube River (European Corridor VII), in the east by Romania and Bulgaria, and that it is led to the capital by the main road Belgrade - Kladovo, the so-called "Djerdap highway" (E-25.1.) Of all the modes of transport important for the development of rural tourism, two have a key role. It is about road and river traffic. Unfortunately, railway traffic is not included in the priority types. The reason is that the railway traffic in Serbia has been in a very bad condition for several decades. Having in mind the current economic and political situation, there are very poor prospects that it will be invested in this area in the near future. *River traffic.* The area of the Lower Danube is bordered on the north by the Danube River, which represents the European Corridor VII. A special impetus to the further development of river traffic on the Danube was given by the construction of the Rhine-Main-Danube canal, the opening of which in 1992 opened a new transit route of combined and direct shipping from the Atlantic Ocean to the Black Sea through Serbia. The Danube River is a traffic "link" between Western Europe and the countries of the Middle East. This is important because tourists who cruise the Danube can get acquainted with the contents of rural tourism. Thus, for example, it is possible to organize a bed and breakfast in one of the facilities of rural tourism. On that occasion, tourists would have the opportunity to get acquainted with the local tradition, food prepared in the traditional way, etc. Ports and marinas on the Danube already exist, and the construction of new ones is planned, as well as the modernization of the existing ones. *Road traffic.* The main traffic corridor for the development of tourism, and thus important for the development of rural tourism, is the road highway Belgrade - Kladovo (E-25.1.) so-called "Djerdap highway". Through it, local municipalities and the National Park "Djerdap" are connected with Corridor 10. Most of the road traffic network belongs to the modern type of road, although according to people from municipal administrations, there are local roads leading to some villages, ie hamlets that are not yet paved. If the development of rural tourism is desired in the future, this shortcoming must necessarily be eliminated.

Tourist attractiveness in the area of Lower Danube region

Three main tourist attractions are characteristic in this area: 1. Danube River (European Corridor VII); 2. „Djerdap“ National Park with Djerdap Gorge; and 3. “Lepenski vir” archaeological site. In addition to these, in the area of the Lower Danube there are numerous other potential tourist attractions - natural and social.

Table 1. Tourist attractions of the Lower Danube region

No.	Municipality	Main tourist attractiveness	
		Natural	**Anthropogenic**
1.	**Veliko Gradište**	- Danube river (European corridor 7.) - Silver lake	- Fortress „Рам“. - Monastery „Нимник“. - National Museum Legacy of the Djordjevic Brothers
2.	**Golubac**	- Danube river (European corridor 7.) - National park «Djerdap»; - Djerdap gorge - - Brnjica river canyon - - Ridan Waterfall;	- Golubac Fortress - Monastery „*Tumane*“. - Ancient settlements: „*Vicus Cuppae*“and „*Castrum Nove*”. - Cultural monuments in the city.
3.	**Kučevo**	- A large number of caves; - Gold-bearing Pek River; - Mineral waters: Duboka and Banja - 2 Waterfalls: in Rakova Bara and in Ceremošnja, - Wellhead: “Shumeće”	- Summer house of King Alexander I Karadjordjevic; - Ancient archeological complex from the 3rd century AD. e. “Karku Lu Jordan” is located in the area of the village “Brodica”.
4.	**Majdanpek**	- National park «Djerdap»; - Rajko’s cave - Bigrena accumulation - “White Source”; - Natural stone bridge “Valja Prerast”.	- Archaeological site “Lepenski vir” - Archaeo-metallurgical site “*Rudna Glava*”; - Churches: st. Apostles Peter and Paul and St. Nicholas. The churches date from the 19th century. - Captain Miša’s building in Donji Milanovac; - Technical house.

No.	Municipal-ity	Main tourist attractiveness	
		Natural	Anthropogenic
5.	**Kladovo**	- Djerdap National Park; - Gorge "Kazan" in Djerdap gorge - Belederijski waterfall - Bird oasis in Mala Vrbica; - Hiking trails on Miroč	- "*Trajan's board*" - "*Trajan's Bridge*" - Diana Fortress - Archaeological site "*Glamija*" - Fetislam Fortress - Monastery of St. Three - Archaeological Museum
6.	**Negotin**	- Natural stone doors: "Large outgrowth", "Small outgrowth" and "Dry outgrowth"; -Excursion site "Mokranjske stones" located 10 km south of Negotin city.	- Museum of Krajina "founded 1934. - "City Museum Hajduk Veljko". - There are as many as 6 monasteries on the territory of the municipality - „Negotin pubs"

Source: Data of Tourist organizations of Veliko Gradište, Golubac, Kučevo, Majdanpek, Kladovo, Negotino.

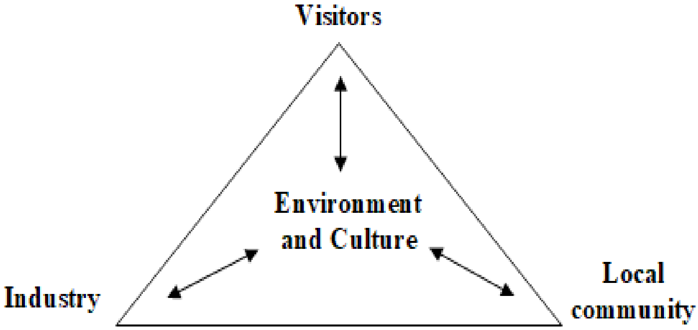
Characteristic of sustainable development rural tourism in the area of Lower Danube

It is important to highlight that many international organizations which are dedicated to the rural tourism (UNWTO, OECD, EuroGites, etc.) and different authors in scientific literature are agreed that „rural tourism is not based on stimulating mass arrivals, but focuses on a targeted "exclusive" market that needs a holiday that offers "something different, different and specific" ie. rural tourism does not belong to mass types of tourism". (Tyrväinen, L. at al. 2001; OECD 1994, EuroGites, etc.).

Rural tourism cannot be developed against its own rural environment – rural areas. Basically in „Encyclopedia of Tourism"(2005) it is clearly defined that rural area represent base for its existing and on which it can be developed.

On that sense it is very important to highlight approach that UNWTO promoting regarding sustainable tourist development. Namely, (UNWTO 2007, p.13) define the VICE model (figure 1) which is important for tourist destination management. Model is based on „interaction between the visitors, the industry that servers them, the community that hosts them and the environment where this interaction takes place. The last of these, the environment, can be understood in its broadest sense to include built and natural resources on which many tourism products are based".

Figure 1. VICE model



Source: UNWTO (2007), A Practical Guide to Tourism Destination Management, p.12.

Having in mind that this area, among the other things, covers in total territory of the National park "Djerdap", archeological site "Lepenski vir, etc., for development rural tourism is very important sustainable tourism approach that UNWTO suggested.

Rural tourism is now in first stage of development which main characteristic is that it is developing without any serious planning. To get across in second phase of development well known as phase of dedicated development where state must invest on its development, it is important that all stakeholders must doing its rural tourism business in accordance with approach on which UNWTO insist. On that way it can be protected all natural and social (anthropogenic) resources of this area.

Conclusion

The Lower Danube region has many natural and social (anthropogenic) resources which are suitable for developed tourism. Rural tourism has developed in this area so far, spontaneously, sporadically, without any clear planning process in this area so far.

In this region nowadays six local tourist organizations exist. For the future development of rural tourism, their networking in all business segments is very important. Main characteristic of this organizations in business are to promote this region as tourist destination. But Serbian Law of tourism (Official Gazette 17/2019) also gave opportunity to be formed tourist destination management organizations. Its scope of work is much wider because it can manage with local tourist resources. It is expecting that in near future some kind of this organization will be forming and that rural tourism will be in focus of it work. On that way rural tourism will be developing according with all premises of sustainable development according with all described and requesting law regulations.

Literature

1. Djurović, D., & Cvejić, S., (2011): „*Ruralni turizam kao činilac ruralnog razvoja*“, SeCons – grupa za razojnu inicijativu, Održivi turizam u funkciji ruralnog razvoja, zajednički porogram OUN u Srbiji web link: http://www.secons.net/admin/app/webroot/files/publications/SeConSizvestajruralniturizamsumarni.pdf
2. Enciclopedia of Tourism (2005), published by Routledge, 2 Park Square, Milton Park, Abingdon, Oxon, OX 144 RN, Simultaneously published in the USA and Canada by Routledge, 270 Madison Ave, NY, 10016.
3. Lane B. (1994): “What is Rural Tourism”, Journal of Sustainable Tourism, No.1-2, Vol. 2. p. 7-21. Special issue: Rural Tourism and Sustainable Rural Development.
4. Law on Tourism of the Republic of Serbia, Official Gazette 17/2019.
5. OECD/GD (94)/49: “Tourism Strategies and Rural Development”, 49, web link: http://www.oecd.org/dataoecd/31/27/2755218.pdf (на дан 26.10. 2020 год.).
6. Strategija razvoja turizma Republike Srbije 2016 – 2025, Vlada Republike Srbije, Ministarstvo trgovine, turizma i telekomunikacija.
7. Tyrväinen, L., Silvennoinen, H., Nousiainen, I. and Tahvanainen , L. (2001). Rural Tourism in Finland:Tourists’ Expectation of Landscape and Environment. Scandinavian Journal of Hospitality and Tourism, 1:133–149.
8. UNWTO (2007): „A Practical Guide to Tourism Destination Management“, Madrid, 2007, web. site: http://pub.unwto.org/WebRoot/Store/Shops/Infoshop/4745/8BCE/AD9A/ECA8/048B/C0A8/0164/0B7A/071115_practical_guide_destination_management_excerpt.pdf (accessed: 05.10.2020. год) .
9. Vuković, P., (2017): „Character and dynamics of development rural tourism in the Republic of Serbia“, journal: Ekonomika, No. 4. Vol. 63, pp. 53 – 60.

Internet sources:

10. EUROGITES, https://eurogites.org/ (accessed: 22nd November 2020)

WHAT ACTUALLY DRIVES AGRICULTURAL LAND MARKET IN SERBIA NORTH

Rade Popović[1], *Danilo Đokić*[2], *Žana Jurjević*[3]

Abstract

Patterns of agricultural land control in Serbia are changing since 1989, when Act of "Land maximum" ceased. Consequently, structural changes of farms in Serbia sped up. Number of farms was decreasing, while average size increased, but not in all types of farm. Serbian agriculture production is based on two main production regions: north, plain and south, hilly region with completely different farm structures. The main goal of this paper was to research which factors, on farm level, influence agricultural land control (owned and rented) in Serbia North region, focusing on 8 basic types of farming. Three driving factors were examined on farm level using Farm accountancy data network (FADN) data: productivity, technical efficiency and profit in period 2017 to 2019. Weighing all elements on national level revealed us its positive correlation with increase in used agricultural area (UAA). The strength of association ranges from moderate to high, while technical efficiency and profit explain most of the variation in land control changes by farm types.

Key words: *land control, farm types, productivity, technical efficiency, profit.*

Introduction

Serbian statistics office significant improved possibilities for understanding of farm structure and trends after Census of Agriculture 2012 and Farm Structure Survey in 2018 (SORS, 2019a,b). Those two important databases enable analysis of farm structure changes in wide range. One approach, is identifying trends in agricultural land control by farm types. Serbian agriculture is divided on two regions plain north and hilly south. Farms structures in region Serbia North are significantly differ

1 Rade Popović, Ph.D., Full Professor, University of Novi Sad, Faculty of Economics, Segedinski put no. 9-11, 24000 Subotica, Serbia, Phone: +381 63 80 41 301, E-mail: rade.popovic@ef.uns.ac.rs

2 Danilo Đokić, M.Sc., Teaching Assistant, University of Novi Sad, Faculty of Economics, Segedinski put no. 9-11, 24000 Subotica, Serbia, Phone: +381 65 87 84 030, E-mail: danilo.djokic@ef.uns.ac.rs

3 Žana Jurjević, M.Sc., Teaching Assistant, University of Novi Sad, Faculty of Economics, Segedinski put no. 9-11, 24000 Subotica, Serbia, Phone: +381 63 89 81 128, E-mail: zana.jurjevic@ef.uns.ac.rs

from farms in Serbia South region. Besides, diverse production conditions, farms in Serbia North are bigger in average size and more focused on specialization. Number of farms with used agricultural land in Serbia North decreased from 173,738 to 156,819 in period 2012 to 2018 (SORS, 2019a,b). Total drop of 16,919 farms originated dominantly from all types of livestock farm decreased by 27,652. Some livestock farms sized production and some switched to crop or fruit type of production. Structural changes, in seven years period, resulted with increased average size of controlled farmland from 10 to 10.9 hectares, for all farm types.

Considerable changes had happened, and some land control trends in future can be expected to continue. But, missing link to understand what drives farms to change types of farming and their strategic decision to increase controlled agricultural area are microeconomics, farm level data.

Since 2011 Serbia start to build Farm Accountancy Data Network (FADN) as precondition in process of EU integration (FADNS 2019). After establishing of FADN, system was developing in several years. Data quality and quantity improved significantly during years and from 2017 to onward data base become more consistent. Use of FADN microeconomics data enables research of elements that drive farm strategic changes.

Material and methods

Research in this paper is based on three sources, two for quantitative and one for qualitative data. First source was database of Serbian Statistic Office, for data of farm structure in 2012 and 2018 (SORS, 2019a,b). In order to explore trends in farm types structural changes and land control, year rate of land control changes was calculated. Second, FADN sample farm database for three-year period 2017-2019 (publicly available data and on request) served as source to assess productivity, technical efficiency and profit of all eight farm types (TF8) in Serbia. TF8 includes: fieldcrops, horticulture, wine, fruits, milk, other grazing livestock, granivores (pigs and poultry) and mixed. Data for farms in FADN sample for Serbia North were additionally weighted on regional level.

First, productivity in form of partial labour productivity at farm is calculated as ratio of value of total output balanced with current subsidies and taxes, and total labour input expressed in annual work units (AWU)[4]. Second element, farms efficiency is estimated as technical efficiency of one output and four input variables for each farm. Output is measured by total output balanced with current subsidies

4 One AWU is calculated as 1,800 working hours per year.

and taxes (RSD). Range of inputs are covered by: total intermediate consumption (RSD), labour input (hours/year), total fixed assets minus land value (RSD) and total UAA (ha). Technical efficiency is assessed by the Data envelopment analysis (DEA) model, using input-oriented method with variable return to scale (VRS), developed by Banker et al. (1984). Calculation is done using software DEAP, Version 2.1 developed by Tim Coelli (1996). Profit is analysed in form of farm net income. Type and strength of connection between average growth rate of changes UAA per farm and examined variables is determined by correlation coefficients. Third source, for qualitative data was extensive literature in field of land market and land use changes in other countries and regions.

Results

Very wide range of former researches proved complex field of land use and land control changes and its drivers (Vliet et al. (2015), Forgord, Bjorkhaug, Burton (2014), Czyzewski, Kulyk, Kryszak, (2019)). Agricultural land use and control drivers are numerous and connected with land market, both selling and rental market. There is not consensus about main drivers, that range from farm technical efficiency to hedonic approach Choumert, Phelinas, (2015).

Farm structure in Serbia is changing. Total farm number on North are decreased for 16,919 farms recently in seven-year period (Table 1). With its distinctive characteristics each type of farm has its own transition model resulting in changed farm number and UAA.

Table 1. Farm structure and UAA changes in Serbia North region during period 2012 to 2018.

TF8	2012		2018		2012-2018 Change	
	Farm number	UAA	Farm number	UAA	Farm number	UAA
Fieldcrops	74,565	1,300,500	86,326	1,303,561	11,761	3,061
Horticulture	3,239	7,049	3,366	7,817	127	769
Vineyards	490	3,562	406	3,498	-84	-64
Fruit	7,375	19,821	9,691	34,066	2,316	14,245
Milk	2,615	23,530	1,296	11,379	-1,319	-12,152
Other grazing livestock	2,853	12,138	2,431	8,551	-422	-3,586
Pigs and poultry	26,722	23,609	14,327	28,327	-12,395	4,718
Mixed	55,879	354,025	38,976	315,644	-16,903	-38,382
Total:	173,738	1,744,234	156,819	1,712,843	-16,919	-31,391

Source: SORS, 2019a,b.

Generally, crop production farm types increased in number, while all livestock producing farm types strongly decreased in total by 31,038 farms. Number of dairying, pig and poultry farms almost halved. Aging labour on livestock farms without successors chose among several strategies: to cease farming or to stay in farming with just crop production. It explains increase in total number of field crops farms. There is also more type farm migration, as for example some small or middle sized field crops farms entering fruit or horticulture production.

All changes in total number of farms and its UAA in Serbia North, during period 2012 – 2018, resulted in 1.41% average growth rate UAA/Farm (Table 2). Despite some lower growth rate then in South region farms on North are 2.5 times bigger, reaching in average almost 11 ha. Half century ago, average size of farms in North region was just 5 ha (SORS, 1967). Data presented in Table 2 indicates specific trends of changes in growth rate of controlled land, for each type of farming. Strong growth of pig and poultry farms should be analysed carefully, since use only 1.65% of total UAA. Bigger and some middle-sized pig and poultry specialized farms usually do not use any agricultural land and completely depends on feed market. Also, negative growth rate of UAA/farm in case of field crops type of farms has to be understood with additional care. Although they are the biggest type of farms, negative rate is result of increased number of farms, because of previously explained migration of livestock type of farms after cessation of livestock enterprises.

Table 2. Average growth rate UAA/Farm in period 2012 to 2018.

TF 8	Average growth rate UAA/Farm		
	Serbia	Serbia North	Serbia South
Fieldcrops	-1.05%	-2.37%	2.13%
Horticulture	2.16%	1.09%	2.85%
Vineyards	-1.28%	2.87%	-1.45%
Fruit	5.97%	4.58%	6.68%
Milk	4.87%	-0.41%	6.75%
Other grazing livestock	1.66%	-3.12%	2.68%
Pigs and poultry	10.12%	14.37%	5.99%
Mixed	2.47%	4.18%	2.01%
Average:	1.76%	1.41%	2.18%

Source: SORS, 2019a,b.

In Table 3 are presented calculated data for three variables in three years period, weighted on regional level. It should be noticed that production and market years in observed period are quite different. Year 2017 was one of worst production years in last couple decades. Extreme drought during second half of production season halved yields in field crop and fruit production. At same time agricultural product prices didn't changed, strongly influenced by global market where production remain stable. Production conditions in 2018 and 2019 were slightly above average achieving higher yields. On market, prices of corn, oilseeds and livestock dropped in same period.

Labour productivity data calculated in value of production per AWU variate across types of farming and per years in observed period. Lowest productivity for all type of farming in observed period is encountered in 2017, where only farms specialised in vineyards production achieved some better results. Dry conditions with long sunshine period favoured only grape producers. According FADN dataset the most labour productive types of farming in three-year period are: pigs and poultry, followed by horticulture, field crops and dairy farms. On opposite side, lowest productivity realised by vineyard farms.

Estimated technical efficiency coefficients revealed higher level of efficiency on specialized types of farming. The most technically efficient types of farming are pig and poultry farms. To the same group belongs: horticulture, fruit and field crop type of farming. Dairy farms in observed period encountered the lowest level of technical efficiency. Some previous researches come to same conclusion (Popovic et. al, 2019a,b)

Third variable, profit is calculated as average farm income. It is measure of farmer return on owned resources: labour, land, management and capital. With the exemption horticulture and fruits type of farming all other encountered the lowest profit in 2017. The biggest profits per average farm are reached by pigs and poultry farm type, followed by horticulture and dairy farms. The worst profits encountered by vineyards, then fieldcrops and mixed type of farms.

Next step in analysis was identification of relationship between changes of growth rate of controlled land per type of farming and calculated variables. The main goal of this step is to assess strength of association and direction of relationship between growth rate UAA/farm types and each of nine variables (Table 4).

Estimated correlation coefficients proved positive linear relationship of growth rate of land control per all eight types of farming for each of three estimated variables in all three-year period. Strength of association range from weak to strong. Weak positive association exist only in case of achieved profit in 2017, what was expectable. Technical efficiency correlation is proved as strongest in average.

Table 3. Weighted data of labour productivity, technical efficiency coefficients and profit of farms in Serbia North from 2017 to 2019.

TF 8	Labour productivity (RSD/AWU)			Technical efficiency			Profit (RSD/farm)		
	2017	2018	2019	2017	2018	2019	2017	2018	2019
Fieldcrops	3,771,969	3,867,313	4,289,835	0.404	0.432	0.436	1,306,382	1,611,248	1,642,812
Horticulture	2,653,620	4,359,894	5,536,235	0.560	0.789	0.585	3,177,682	2,812,934	4,135,459
Vineyards	2,834,054	1,306,840	1,696,247	0.420	0.252	0.370	971,728	1,461,291	1,124,425
Fruit	2,412,799	2,347,919	2,945,589	0.446	0.594	0.463	3,163,751	1,883,593	2,457,385
Milk	2,716,854	3,975,497	4,399,672	0.333	0.372	0.302	1,746,326	3,403,109	3,812,580
Other grazing livestock	2,389,101	3,470,509	3,327,758	0.348	0.302	0.410	1,783,194	2,572,967	3,292,544
Pigs and poultry	5,203,845	8,500,770	9,650,999	0.670	0.825	0.674	2,942,910	10,320,830	5,719,201
Mixed	2,073,818	3,170,981	3,300,121	0.351	0.384	0.403	1,351,264	1,761,873	1,863,732

Source: Author calculation based on FADNS 2017-2019.

Table 4. Correlation of rate of change UAA/Farm, labour productivity, technical efficiency and profit.

	Yearly rate change UAA/Farm	Labour productivity			Technical efficiency			Profit		
		2017	2018	2019	2017	2018	2019	2017	2018	2019
Yearly change UAE/Farm	1									
Labour productivity 2017	0.617	1								
Labour productivity 2018	0.624	0.811	1							
Labour productivity 2019	0.659	0.819	0.988	1						
Technical efficiency 2017	0.753	0.723	0.721	0.801	1					
Technical efficiency 2018	0.616	0.525	0.709	0.793	0.890	1				
Technical efficiency 2019	0.670	0.646	0.746	0.803	0.947	0.910	1			
Profit 2017	0.452	0.222	0.475	0.553	0.694	0.881	0.730	1		
Profit 2018	0.790	0.826	0.931	0.926	0.760	0.642	0.708	0.465	1	
Profit 2019	0.500	0.534	0.864	0.873	0.661	0.723	0.659	0.685	0.846	1

Source: Author calculation based on FADNS 2017-2019.

Moderate positive linear relationship of yearly rate of change UAA/farm exist in case of labour productivity in all three years, technical efficiency in 2018 and 2019 and profit in 2019. Only for two variables correlation is evaluated as strong positive. It is case for profit earned in 2018 and technical efficiency in 2017.

Strong positive correlation coefficients between labour productivity in all three years, as well as between technical efficiency are proving data consistency in database for three-year period. In case of correlation coefficients among earned profit in observed period there is not such strong association. It is expectable, since production and market conditions variate from year to year and do not affect equally all types of farm.

Conclusions

This study, based on two sources of statistical data, revealed few elements on farm level associated with changes in land control per TF8. Land market in region Serbia North, looking on farm busines characteristic by types of farming, achieved in period 2017-2019, was driven mainly by technical efficiency and profit.

Farm structural changes in Serbia North region will continue in the future. Farms will adjust production strategies looking for more adequate types of farming, according quality and quantity of controlled resources. Changes on both land market purchase and rental will lead in long term to increased land control per farm.

Literature

1. Banker, R., Charnes, A., Cooper, W. (1984): *Some models for estimating technical and scale inefficiencies in data envelopment analysis*, Management science, vol. 30, no. 9, pp. 1078-1092.
2. Choumert, J., Phelinas, P. (2015): Determinants of agricultural land values in Argentina, Ecological Economics, vol. 110, pp. 134-140.
3. Coelli, T. J. (1996): A guide to DEAP Version 2.1: A Data Envelopment Analysis (Computer) Program. CEPA Working Paper 96/08, Department of Econometrics, University of New England, Armidale.
4. Coelli, T. J. (1996): A guide to DEAP Version 2.1: A Data Envelopment Analysis (Computer) Program. CEPA Working Paper 96/08, Department of Econometrics, University of New England, Armidale.

5. Coelli, T. J., Rao, D. S. P., O'Donnell, C. J., Battese, G. E. (2005): *An introduction to efficiency and productivity analysis*. Springer Science & Business Media, Berlin, Germany.
6. Czyzewski, B., Kulyk, P., Kryszak, L. (2019): Drivers for farmland value revisited: adapting the returns discount model (RDM) to the sustainable paradigm, Economic Research-Ekonomska istraživanja, vol. 32, no. 1, pp. 2080-2098.
7. FADNS (2017): *Farm Accountancy Data Network Serbia*, database of Farm Accountancy Data Network of the Republic of Serbia (FADNS), facts for 2017, available at: www.fadn.rs, accessed at: 15th November 2020.
8. FADNS (2018): *Farm Accountancy Data Network Serbia*, database of Farm Accountancy Data Network of the Republic of Serbia (FADNS), facts for 2018, available at: www.fadn.rs, accessed at: 15th November 2020.
9. FADNS (2019): *Farm Accountancy Data Network Serbia*, database of Farm Accountancy Data Network of the Republic of Serbia (FADNS), facts for 2019, available at: www.fadn.rs, accessed at: 15th November 2020.
10. Forgord, M., Bjorkhaug, H., Burton, R. (2014): *Drivers of change in Norwegian agricultural land control and emergence of rental farming*, Journal of Rural Studies, vol. 33, pp. 9-19.
11. Popović, R., Đokić, D. (2019b). Tehnička efikasnost poljoprivrednih gazdinstava u regionu Srbija sever. Proceedings XXIV International scientific conference Strategic management and deceision support systems in Strategic Management: Izazovi strategijskog menadžmenta u 21. veku: globalizacija, tranzicija, inovacije, transformacija, Subotica 17. May 2019, pp 247-254. ISBN 978-86-7233-380-0
12. Popovic, R., Jurjevic, Z., Djokic, D., Bojcevski, M. (2019a). Farm production efficiency in Serbia. Thematic proceedings X International Scientific Agriculture Symposium "AGROSYM 2019", Jahorina October 03-06 2019, pp 1731-1736. ISBN 978-99976-787-2-0
13. SORS (1967): *Census of Agriculture 1960*. Book 2, Statistical Office of the Republic of Serbia (SORS), Belgrade, Serbia, available at: https://www.stat.gov.rs/sr-cyrl/publikacije/
14. SORS (2019a): *Census of Agriculture in the Republic of Serbia - 2012*., Statistical Office of the Republic of Serbia (SORS), Belgrade, Serbia, available at: http://popispoljoprivrede.stat.rs/popis/wp-content/themes/popis2012/sadrzajeng.htm

15. SORS (2019b): *Farm structure survey (FSS) in Serbia - 2018*, Statistical Office of the Republic of Serbia (SORS), Belgrade, Serbia, available at: www.stat.gov.rs/en-us/oblasti/poljoprivreda-sumarstvo-i-ribarstvo/anketaostrukturipopgazdinstava/
16. Vliet, V. J., Groot, L. F. H., Rietvelt, P., Verburg, H. P., (2015): *Manifestations and underlying drivers of agricultural land use change in Europe*, Landscape and Urban Planing, vol. 133, no. 1, pp. 24-36.

Internet source:

17. https://doi.org/10.1016/j.landurbplan.2014.09.001

PRODUCTION POTENTIALS AND EXPORTS OF THE FOOD INDUSTRY OF VOJVODINA

Stanislav Zekić[1], Bojan Matkovski[2], Marija Jeremić[3], Danilo Đokić[4], Žana Jurjević[5]

Abstract

The food industry is a relatively important sector of the Serbian industry, especially in Vojvodina. The mill, sugar, and oil industries are of the greatest importance and, to a lesser extent, the slaughter industry. For the afore mentioned sectors in Vojvodina, there are strong resource potentials in terms of the production of raw materials and significant processing capacities. This paper aims to point out the main problems of the most important branches of the food industry of Vojvodina through the analysis of production potentials and export performances. Results showed that Vojvodina's food industry is characterized by great diversity in capacity, technological level, and marketing approach. Although small enterprises are present to a certain extent, the food industry's main characteristic is oversizing in almost all segments and divergent development after the privatization that has been carried out in the past two decades.

Key words: *Vojvodina, food industry, production performance, competitiveness.*

Introduction

The food industry is a relatively important branch of the Serbian industry, with a share in the Gross Domestic Product (GDP) of 3.5% and total employ-

1 Stanislav Zekić, Ph.D., Full Professor, University of Novi Sad, Faculty of Economics, Department of Agricultural Economics and Agribusiness, Segedinski put no. 9-11, 24000 Subotica, Serbia, Phone: +381 21 485 29 45, E-mail: stanislav.zekic@ef.uns.ac.rs

2 Bojan Matkovski, Ph.D., Assistant Professor, University of Novi Sad, Faculty of Economics, Department of Agricultural Economics and Agribusiness, Segedinski put no. 9-11, 24000 Subotica, Serbia, Phone: +381 24 628 049, E-mail: bojan.matkovski@ef.uns.ac.rs

3 Marija Jeremić, Ph.D., Assistant Professor, University of Novi Sad, Faculty of Economics, Department of Agricultural Economics and Agribusiness, Segedinski put no. 9-11, 24000 Subotica, Serbia, Phone: +381 24 628 065, E-mail: marija.jeremic@ef.uns.ac.rs

4 Danilo Đokić, M.Sc., Teaching Assistant, University of Novi Sad, Faculty of Economics, Department of Agricultural Economics and Agribusiness, Segedinski put no. 9-11, 24000 Subotica, Serbia, Phone: +381 24 628 049, E-mail: danilo.djokic@ef.uns.ac.rs

5 Žana Jurjević, M.Sc., Teaching Assistant, University of Novi Sad, Faculty of Economics, Department of Agricultural Economics and Agribusiness, Segedinski put no. 9-11, 24000 Subotica, Serbia, Phone: +381 63 89 81 128, E-mail: zana.jurjevic@ef.uns.ac.rs

ment of 4.6%. In Vojvodina, the relative importance of this sector is higher with approximately 7% of employees, i.e., the food industry employs slightly less than 34 thousand workers (SORS, 2020).

Although small companies dominate, the food industry's characteristic is oversized in almost all segments and different development after the privatization that has been carried out in the past two decades. Significant foreign investments are directed towards this industry in Vojvodina (PKV, 2018), which today is characterized by different technical and technological equipment, as well as the growing need to adapt to the requirements of modern retail chains (The Republic of Serbia commission for protection of competitors, 2018), which require the mass introduction of standards in order to guarantee the quality and safety of food.

In the past decades, numerous changes have taken place in Serbia's economic system, which has led to market liberalization, so it has opened the borders of many markets for products from Serbia. Namely, the liberalization of the market, which takes place in the current integration processes, has conditioned the determination of changes in the structure of imports and exports, the main foreign trade partners and position, i.e. the comparative advantages of the agri-food sector (Božić, Nikolić, 2016). For example, studies show that only the Stabilization and Association Agreement (SAA) has affected the growth of export of the agri-food products to European Union (EU) countries by about 55.5% (Matkovski, Radovanov, Zekić, 2018).

This paper analyzes the state and potentials of the main subsectors of Vojvodina's food industry, i.e., the levels of production and exports and the importance of this industry concerning other regions in Serbia. In some industries, such as the sugar and oil industry, almost all processing capacities are located in Vojvodina, i.e., Serbia's entire production is concentrated in this region, so the flour industry and, to a lesser extent, the meat industry are of great importance for analysis.

Material and methods

Production and export performance of the food industry of Vojvodina were analyzed by the available data within the official database Statistical Office of the Republic of Serbia – SORS (2020), as well as data from Census of Agriculture (2012), and The Serbian Business Register Agency – SBRA (2020). The data, not available in the publicly available SORS database, was obtained upon special request to this public organization. The period of data availability was determined by the period of analysis during the research.

It is necessary to point out the limitations of the research regarding the data used in the research within this chapter. Namely, the data on produced quantities at the level of the statistical region of Vojvodina are taken from the research conducted in order to calculate the index of physical volume of industrial production, and not in order to see the quantities of produced products, so they have less coverage than industrial research. However, industry research is conducted only at the Republic of Serbia, and companies are conducted exclusively by headquarters, regardless of the location of production facilities, which prevents their use in this type of analysis. The problem with data on foreign trade relates to the fact that the regional presentation of trade is conducted according to the owner of the goods' headquarter at the time of acceptance of the customs declaration, which does not necessarily correspond to the location of production capacity.

Results and discussion

Production performances of the main segments of food industry of Vojvodina

As production performances of the food industry are concerned, the most important branches are the mill, sugar, and oil industries, and to a lesser extent, the slaughter industry. Vojvodina has significant mill capacities for flour production. In recent years, about 400 thousand tons of flour are produced in Vojvodina (Figure 1), representing almost 80% of the total flour production in Serbia. Vojvodina's wheat production takes place on about 300 thousand hectares, which makes up more than half of the wheat harvested area in Serbia. The wheat in Vojvodina is produced on 55,790 agricultural farms, and approximately 60% of the harvested area is cultivated by 4,584 agricultural farms that own more than 50 hectares (Census of Agriculture, 2012). In wheat production, Vojvodina has higher yields than the southern part of Serbia (SORS, 2020), and there are 52 mills with a processing capacity of about 15 million tons (RAV, 2020). The total capacity for storing grain is 620 thousand tons, of which 550 thousand tons are in a grain elevator. It is estimated that approximately 55% of Serbia's capacity is used (Official Gazette of Republic of Serbia, 2014). The flour production varied slightly, and the lowest production volume in Vojvodina was recorded in 2018 when 356 thousand tons of flour were produced (SORS, 2020).

Figure 1. Production performances of food industry of Vojvodina

Source: Authors` calculations on basic of SORS, 2020.

The sugar production in Vojvodina has a tradition of more than one century, and currently, the total sugar production in Serbia is located in five sugar refineries (SBRA, 2020). In the last few years, sugar production averaged about 475 thousand tons, while sugar beet production in Vojvodina amounted to about 2.6 million tons (Figure 1). About 96% of total sugar beet production in Serbia is concentrated in Vojvodina, with the presence of vertical integration in the sugar industry. Also, considering that more than 70% of the area under sugar beet is cultivated by agricultural farms that own more than 100 hectares, the production concentration is very present (Census of Agriculture, 2012). Currently, there are only two companies that organize sugar production in five sugar refineries on the sugar market. The Sunoko company owns sugar refineries in Vrbas, Pećinci, and Kovačica, while Hellenic sugar production is located in Crvenka and Žabalj. The sugar industry currently employs about 800 workers (SBRA, 2020), but having in mind the fact that the sugar beet is produced on 2,324 agricultural farms that contract production with sugar refinery, the number of people directly or indirectly involved in sugar production is about 7,000. Capacities are not fully utilized. At the same time, considering the demand on the domestic market, limited possibilities of the export market and high level of concentration capacities are oversized (Official Gazette of Republic of Serbia, 2014). Namely, the sugar market is characterized by a very high level of concentration on the supply side. That is it has the characteristics of an oligopoly with two dominant participants (Krstić, Radivojević, Stanišić, 2016).

The Republic of Serbia is one of the largest producers of oilseeds in the Western Balkan region, and at the same time, it has the largest oilseeds processing capacities. Due to extremely favorable natural conditions, the largest share of oilseeds production and processing is concentrated in Vojvodina. About 91% of oilseeds harvested area and 93% of total Serbian oilseeds production is located in Vojvodina. In 2012-2018 average annual production was 494 thousand tons for sunflower, 445 thousand tons for soybeans, and about 40 thousand tons for rapeseed (SORS, 2020). The sunflower is produced on 23,893 agricultural farms, and even 61% of the area harvested is concentrated on 13% of agricultural farms that own more than 50 hectares (Census of Agriculture, 2012). The soybean is produced on 25,219 agricultural farms, and 8 % of farms that own more than 50 hectares cultivate about 54% of areas under soybean (Census of Agriculture, 2012). The oilseeds "processing capacities allow for annual processing of about 885 thousand tons of sunflower, 482 thousand tons of soybean, and 247 thousand tons of rapeseed. However, oil production is much lower, and an average utilization rate of processing capacity is about 40% for sunflower and 70% for soybean" (Official Gazette of Republic of Serbia, 2014). The production of refined vegetable oil in Vojvodina in the period 2012-2018 averaged 174 thousand tons (Figure 1), and considering the location of processing capacities in Vojvodina this is almost 100% production of refined vegetables oil for Serbia (Figure 1). In the same period, the margarine and hydrated vegetable fat production in Vojvodina averages 33 thousand tons, representing 94% of Serbia's total production (SORS, 2020). Although the existing processing capacities could process much more oilseeds than it is currently processed per year, a significant proportion of oilseeds produced are exported, partially due to non-competitive payments to producers by processors. The oilseeds processing industry is characterized by an unstable environment characterized by short-term decision making (SEEDEV, 2017). Also, some oil factories have been leased in certain years, and there have been cases of distortions of competition in the edible oil market. The largest producer of oil is Victoriaoil from Šid. Significant producers are Vital from Vrbas, Novo Sunce from Sombor, Banat from Nova Crnja, and Sojaprotein from Bečej. Viktoriaoil and Sojaprotein are part of Viktoria Group, Vital is part of the Invej, and Bimal is the owner of Novo Sunce (Matkovski, Jeremić, Đokić, Jurjević, 2020). These companies alone employ about 2,000 workers (SBRA, 2020), but the number of people that are directly or indirectly involved in this activity is much higher.

Livestock production represents a more intensive part of agricultural production, and meat production, as its dominant part, is a source of raw materials for the slaughter industry. In 2012-2018 the meat production in Vojvodina grew at an average annual rate of 3.9% and ranged from 62 thousand tons in 2012 to over 77 thousand tons in 2016 (SORS, 2020). Pork and poultry meat are the most dominant types of meat produced in Vojvodina with a share of 51% and 41%, respectively. Vojvodina has excellent production conditions for pigs and poultry raising and could be price competitive in this sector due to relatively cheap fodder access. In Serbia, traditionally, a large part of animals is slaughtered on individual farms, which is especially pronounced in the case of pigs and sheep farming, and that is why the actual production and consumption of meat is probably higher (Jeremić, Zekić, Matkovski, 2016). Sausage products and canned meat are the dominant outputs in meat processing and their production in Vojvodina in the period from 2012-2018 recorded different tendencies. Namely, the production of sausage products is relatively stable and ranges from 41 and 44 thousand tons. The production of sausage products is growing at an average annual rate of 1%, while the volume of canned meat production decreased significantly between 2012 and 2014 and has stabilized at a level of about 12 thousand tons per year (Figure 1). The largest meat processors in Vojvodina are large agribusiness companies: Neoplanta Novi Sad, Carnex Vrbas, Matijević Novi Sad, Industrija mesa Topola, etc. Those companies have recognizable brands on the domestic market and the market of neighbouring countries, and some have their own retailing facilities.

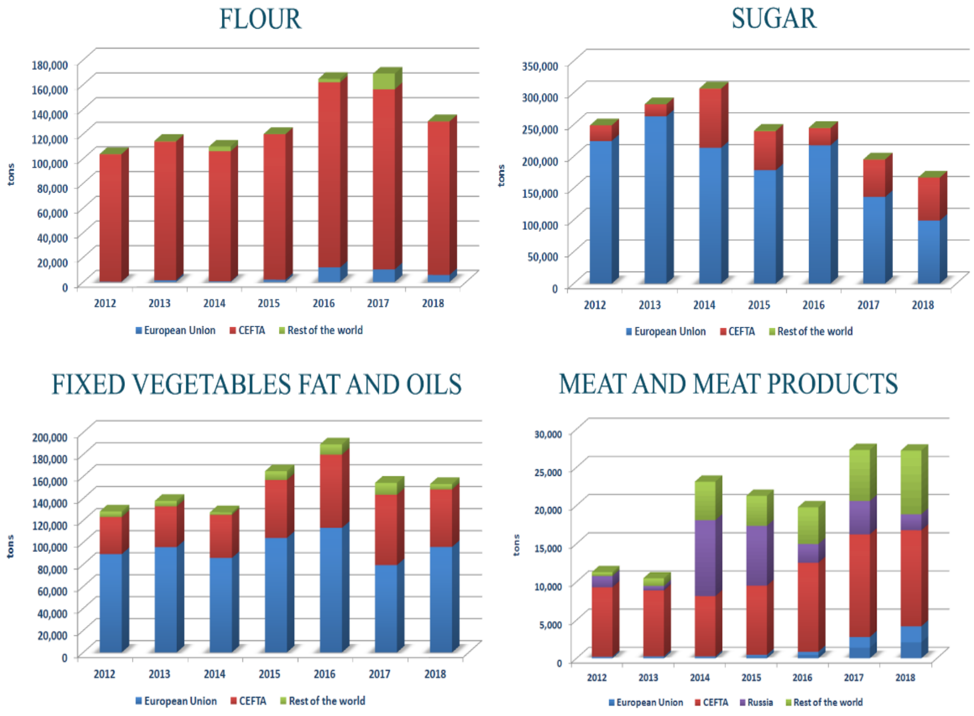
Export performances of the main segments of food industry of Vojvodina

Vojvodina leads in the export of wheat - 80% of the wheat export in Serbia is realized from Vojvodina in the period from 2012-2018. In the case of flour, a slight decline in production caused a decline in exports. About 130 thousand tons of flour were exported in 2018 (Figure 2), which represented 76% of total flour exports from Serbia. The main export market is the Central European Free Trade Agreement (CEFTA) region. In the analyzed period, 90% of flour was exported to Bosnia and Herzegovina, Montenegro, and North Macedonia. The export of flour in some years is characterized by certain problems, such as introducing complicated procedures for the import of flour into North Macedonia in 2018, which were quickly abolished, but certainly temporarily limited the export and affected foreign trade. Žitobačka from Kula, which operates as part of MK Group, stands out as one of the largest producers and is the largest exporter of flour.

Sugar beet and sugar are essential export products of Serbia. An average annual export of sugar, sugar products, and honey was 252 thousand tons (Figure 2). About 95% of exports were realized from entities whose headquarters are in Vojvodina. The EU has the largest share in export (about 78%). Hungary is the main export market. Important markets from EU countries are also Greece, Bulgaria, Italy, and Romania. Among the CEFTA countries, the most important is North Macedonia, the third-largest export market, after Hungary and Greece. However, significant production results and the export of sugar from Vojvodina, were achieved primarily due to the high customs protection, which suppressed competition and maintained high prices on the domestic market. The good export performances of this sector were also enabled by preferential export quotas for the EU market. However, for many years, the EU sugar market has been artificially maintained by a stable sugar protection policy within the European Union's Common Agricultural Policy, which has maintained high sugar prices through a quota system. However, the quota of sugar production in the EU was abolished in 2017, and the question of the future absorption power of the European Union market arises. The conditions of liberalization, competitive positions will predominantly decide who will survive in the sugar market (Belaya, Hahlbrock, 2016).

The average annual export of oilseeds in the 2012-2018 year from Serbia amounted to 232 thousand tons. About 61% was exported from businesses whose headquarters are in Vojvodina. Significant growth of sunflower exports is noticeable in Bosnia and Herzegovina, which is a consequence of the newly opened processing capacities in this country. Significant markets for oilseeds from Vojvodina are Romania, Hungary, Germany, and Italy. When it comes to the export of fixed vegetable fats and oils, an average of 176 thousand tons was exported from Serbia (Figure 2), 86% from Vojvodina. This section's main export product is sunflower oil, with 66% (40% refined, 26% crude). The export of crude soybean oil is significant, accounting for 28% of exports in this section. The challenge for processing is the growing trend of sunflower exports to Bosnia and Herzegovina. In order to slow this trend, Serbia responded by trying to establish administrative taxes on sunflower exports to Bosnia and Herzegovina (SEEDEV, 2017).

Figure 2. Export performances of food industry of Vojvodina



Source: Authors` calculations on basic of SORS, 2020

A relatively small part of the total Vojvodina meat and meat products is exported. Exports of this category of products range from 10 to 27 thousand tons per year (Figure 2) (an average of over 60% of Serbian exports of meat and meat products). This is very interesting since the share of Vojvodina, measured by the livestock units, is about one-third of all farm animal species in Serbia. This tells us that the production of meat and meat products in Vojvodina is far more competitive on the foreign market compared to the rest of Serbia. The reason is the structure of farms engaged in animal production in central Serbia, where small farms dominate. The largest exports from Vojvodina are realized to the CEFTA countries (Bosnia and Herzegovina and

Montenegro), although more significant exports were recorded to Russia. The reason for unfavorable comparative advantages in the export of livestock products is the stagnation in livestock productions present in Serbia during the last three decades and the impossibility of reaching relatively demanding standards in this sector (Vlahović, 2015).

Conclusions

The food industry in Vojvodina has a special significance for the economy, and in many sectors, it dominates within the national framework. The development of the food industry is affected by favorable agro-ecological potentials, as a key factor for creating the raw material base and the fact that Vojvodina is a region with more intensive agricultural production and commercially oriented agricultural holdings. The process of ownership transformation in Vojvodina's food industry has been relatively successful with a significant role of foreign capital, which has resulted in the improvement and modernization of production. Large producers dominate the production of food products. The greatest comparative advantages in the export of food products from Vojvodina are achieved by sectors based on the processing of plant products: grain processing, oil, and sugar production, while the processing of livestock products - slaughter industry and production has no significant comparative advantage in foreign markets and also in the domicile market, there is more and more foreign competition when it comes to animal products. The dominant market for the export of most food industry products is the surrounding countries, i.e., CEFTA countries, where there is recognisability of the Vojvodina food industry brands. Also, exports to EU countries are significant, while exports to Russia and some other countries are noticeable for some products. In the upcoming period, the growth of competitive pressure is expected, so it is necessary to further improve production, primarily through diversification of supply and the development of marketing activities. A potentially interesting sector could be the offer of small producers, whose performance based on the promotion of quality could be the mainstay of improving Vojvodina's production and export performance.

Literature

1. Belaya, V., Hahlbrock, M. (2016): *Forecast of the EU sugar market after the quota. DMZ*, Lebensmittelindustrie und Milchwirtschaft, 137(26), 8-9.
2. Božić, D., Nikolić, M. (2016): *Obeležja spoljnotrgovinske razemene poljoprivredno-prehrambenih proizvoda Srbije*. Marketing, 47(4), 293-304.

3. Census of Agriculture (2012): *Official basis*: https://www.stat.gov.rs/sr-latn/oblasti/poljoprivreda-sumarstvo-i-ribarstvo/popis-poljoprivrede/
4. Jeremić, M., Zekić, S., Matkovski, B. (2016): *Ekonomske osobenosti proizvodnje svinja u Srbiji*. Agroekonomika, 45(70), 11-18.
5. Krstić, B., Radivojević, V., Stanišić, T. (2016): *Measuring and Analysis of competition intensity in the Sugar Market in Serbia*. Economics of Agriculture, 63(2), 389-406.
6. Matkovski, B., Jeremić, M., Đokić, D., Jurjević, Ž. (2020): *Serbia oil crops export potentials*. Ratarstvo i povrtarstvo, 57(1), 14-21.
7. Matkovski, B., Radovanov, B., Zekić, S. (2018): *The Effects of Foreign Agri-food trade Liberalization in South East Europe*. Economcky casopis, 66(9), 945-966.
8. Official Gazette of Republic of Serbia (2014): *Strategy for Agriculture and Rural Development of the Republic of Serbia for the period 2014-2024*. http://www.minpolj.gov.rs/wp-content/uploads/datoteke/razno/4827014.0116.30-1.pdf
9. SEEDEV (2017): *Competitiveness of Serbian agriculture*, https://www.seedev.org/publikacije/Konkurentnost_poljoprivrede_Srbije/Konkurentnost_Srbije_Analiza.pdf
10. Statistical Office of the Republic of Serbia - SORS (2020): *Official basis*: http://data.stat.gov.rs/?caller=SDDB
11. The Chamber of Commerce and Industry of Vojvodina – PKV (2018): *Informacije o stranim direktnim investicijama u AP Vojvodini. Stručna služba za privredni sistem i ekonomsku politiku*: PKV Novi Sad.
12. Vojvodina Development Agency – RAV (2020): Official website: https://rav.org.rs/
13. The Republic of Serbia commission for protection of competitiors (2018): *Sektorske analize tržišta trgovine na malo u nespecijalizovanim prodavnicama pretežno hranom, pićem i duvanom*, http://www.kzk.gov.rs/kzk/wp-content/uploads/2019/01/Sektoska-analiza-maloprodaja-II-faza.pdf
14. The Serbian Business Register Agency – SBRA (2020): *Official* website: https://apr.gov.rs/
15. Vlahović,B. (2015): *Tržište agro-industrijskih proizvoda – specijalni deo*, http://polj.uns.ac.rs/sites/default/files/udzbenici/KNJIGA-B.-VLAHOVIC-komplet.pdf

CONSERVATION, SUSTAINABLE USE AND INSTITUTIONAL CAPACITIES OF GENETIC RESOURCES OF CEREALS

Svetlana Roljević Nikolić[1]

Abstract

Plant genetic resources which are important for food and agriculture represent only a small part of total biodiversity, but their sustainable management is crucial for maintaining the most expressive genotypes of cultivated crops made by nature itself. In accordance with the requirements of species and possibilities of countries, plant genetic material for food and agriculture is mainly conserved in two ways: in situ or in natural habitats and on farms, as well as ex situ or in gene banks. Taking into account that cereals represent the basis of the world food security, the paper examined the genetic resources of these crops i.e., their state in ex situ preservation conditions. Desk research methodology was used to collect data on the number of samples in the largest collections of cereal germplasm worldwide, with the focus on the genetic resources of wheat and maize. It is estimated that there are more than 1,750 gene banks holding approximately 7.4 million samples of different gene material of plants significant for food and agriculture worldwide. Collections of the two main cereal crops - wheat and maize - make up as much as 15% of the global ex situ conserved germplasm.

Key words: *genetic resources, cereals, gene banks, collections, samples.*

Introduction

Biological diversity, or variability of living organisms, represents a significant resource for human existence. Within the total diversity, a separate group includes plant genetic resources for food and agriculture. This group of the total diversity involves *varieties* (obsolete varieties, varieties represented in production and new varieties), *local populations, relatives* (cultivated or wild plant species) and *different selection materials* (line, pure line, inbred line or hybrid) of all species important for agriculture (Prodanović i Šurlan Momirović, 2006). Genetic variability provides the basic elements for improving the productivity, hardiness and nutritive content of cultivated plants, and represents the foundation for human existence and food security.

1 Svetlana Roljević Nikolić, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 69 72 842, E-mail: svetlana_r@iep.bg.ac.rs

However, the modernization of production and altered nutrition in modern times have resulted in the concentration of global agriculture on only several crops, which has led to the erosion of biodiversity. Today, only 150 plant species provide food for the largest part of global population. Not more than 12 crops provide 80% of calories obtained from plants, while only four plant species (wheat, maize, rice and potato) contribute 60% of calories of plant origin (European Communities, 2007).

The value and significance of plant genetic resources (PGRs) for the future of humanity were recognized as early as in the beginning of the twentieth century. Namely, Russian scientist N.I. Vavilov organized numerous collecting expeditions worldwide in the 1920s in order to find, conserve and use PGRs for research and breeding programmes (Loskutov, 1999). The material collected during these expeditions provided the basis for creating the first germplasm collection in the Bureau of Applied Botany (today N.I. Vavilov Research Institute of Plant Industry).

Nowadays PGRs are conserved in accordance with the species requirements and possibilities of countries in two ways: (1) *in situ* or (2) *ex situ*. *In situ* conservation is the natural and most desirable method, but cannot be applied for all species for various reasons. This method is mostly used for the conservation of wild species, wild relatives and some fruit species, while the *ex situ* method is used for the conservation of cultivated species and species reproduced by means of seeds and micro-propagation. The main forms of *ex situ* conservation are banks of plant genes which apply scientifically based technology and strictly controlled conditions for long-term (over 50 years) and medium-term (up to 20 years) conservation of samples.

It has been estimated that there are more than 1,750 banks worldwide with approximately 7.4 million samples of different genetic material of plants for food and agriculture (Crop Trust, 2016). National genebanks store around 6.6 million samples, 45% of which are held in only seven countries.

Approximately 50% of the germplasm conserved in *ex situ* conditions includes only 10 plant species, while the three largest collections (wheat, rice and barley) account for as much as 28% of the global germplasm. Approximately half of the samples in the collections are selection materials; a third is made of local populations and obsolete varieties, while the smallest percentage is represented by relatives and wild plant species. Although the least represented, the collections of relatives and wild species are the most significant since they represent the basis for increasing the germplasm divergence and breeding in the future (Roljević et al., 2011).

Centres and organizations for conservation of cereal genetic resources

Cereals have a very significant role in ensuring food security of the growing global population, as well as great trade importance. The total area of 718,123,243 ha is covered by cereals worldwide, which represents 45% of arable agricultural land. The global trade in these crops was estimated to be 413 million tonnes in 2019/20 (FAO database, 2018).

Use of the available genetic resources of these crops with the aim of breeding and productivity improvement is also significant in order to alleviate negative impacts of agriculture and food production on the environment (Pimentel et al., 1995).

Owing to their significance, cereals are the species with the largest germplasm collections conserved in genebanks worldwide. There are regional centres and national genebanks in the world conserving the germplasm of only several cereal species, as well as the genebanks focused on only one or two species. Thus, the Chinese Crop Germplasm Information System stores the genetic material of almost all main cereal species, while the Institute for Cereal Crops Improvement and John Innes conserve only the germplasm of three cereal species (barley, oat and wheat).

Table 1. Centres and organizations that store the germplasm of several cereal species

Name centres and organizations	Cereal species maintained
Chinese Crop Germplasm Information System	Barley, maize, millet, oats, rice, rye, sorghum and wheat
Institute for Cereal Crops Improvement	Barley, oats, wheat
John Innes Centre - BBSRC Cereals Collections	Barley, oats, wheat
National Institute of Agrobiological Science GenBank (Tsukuba, Japan)	Rice, barley, wheat, sorghum, millet
National Small Grains Collection (GRIN; Aberdeen, Idaho)	Oats, rice, rye, triticale and wheat

Source: Sachs, 2009

In genebanks, samples are organized into collections. Depending on their purpose, they can be:

- *Base collections* – they contain samples of germplasm under long-term conservation (over 50 years) in order to maintain its genetic identity. Seeds are conserved in cryogenic conditions, at temperatures close to freezing (up to -20 °C) and low humidity in order to ensure their longevity.

- *Active collections* – they represent the part of base collections which is operated with and regularly multiplied in the field and which is available for use, exchange and evaluation. In these collections, the samples are maintained under medium-term storage (up to 20 years) at temperatures from 0 to 10°C and relative air humidity of 20-30%.
- *Core collections* – they contain the representatives of different sample groups with similar characteristics.
- *Gene collections* – they include genotypes with specific characteristics significant for research and development.

State of wheat genetic resources

Wheat is cultivated on 214 million hectares in the world where more than 700 million tonnes of grains are produced, while the global trade in this crop was estimated to be 173.5 million tonnes in 2019/20 (FAO database, 2018). The largest areas cultivating wheat are in Asia (45.3%), Europe (28.4%) and America (16.6%). The main role of wheat as food arises from its proteins which are unique among agricultural crops. Wheat products, primarily bread, represent basic elements of human nutrition. Although wheat is an important factor in ensuring food security, recent years have witnessed the loss of wheat biodiversity due to the world population increase and creation of high-yield and intensive varieties and the accompanying economic and environmental changes (Roljević et al., 2011).

Global wheat production is almost completely based on two species: hexaploid common soft wheat or bread wheat (*Triticum aestivum* subsp. *vulgare)* accounting for more than 95% of global production and tetraploid hard wheat (*T. turgidum* subsp. *durum*).

Genebanks preserve over 800,000 samples in around 80 collections (11% of the total number of *ex situ* samples). These collections vary in size, the largest ones having more than 100,000 samples, and the smallest ones consisting of several hundred samples (Table 2). Germplasm collections contain a large number of duplicates and their number should be determined in future research.

According to the FAO data, the largest number of wheat samples can be found in the international genebank the International Maize and Wheat (CIMMYT) storing 13% of germplasm samples of this crop at the global level. The second largest genebank collection is NSGC in America, conserving 7% of wheat germplasm, followed by genebanks in China (ICGR-CAAS), India (NBPGR), and Syria

(ICARDA) (Table 2). Since there are a large number of genebanks preserving wheat germplasm, Table 3 provides only those whose collections contain more than twenty thousand samples.

Table 2. Genebanks with the largest number of wheat germplasm samples

Gene bank		Samples	
Name	Acronym	Number of samples	%
Centro Internacional de Mejoramiento de Maíz y Trigo	CIMMYT	110.281	13
National Small Grains Germplasm Research Facility, States Department of Agriculture, Agricultural Research Services	NSGC	57.348	7
Institute of Crop Germplasm Resources, Chinese Academy of Agricultural Sciences	ICGR-CAAS	43.039	5
National Bureau of Plant Genetic Resources (India)	NBPGR	35.889	4
International Centre for Agricultural Research in the Dry Areas	ICARDA	34.951	4
National Institute of Agrobiological Sciences (Japan)	NIAS	34.951	4
N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry (Russian Federation)	VIR	34.253	4
Istituto di Genetica Vegetale, Consiglio Nazionale delle Richerche (Italy)	IGV	32.751	4
Genebank, Leibniz Institute of Plant Genetics and Crop Plant Researsh (Germany)	IPK	26.842	3
Australian Winter Cereals Collection, Agricultural Research Centre	TAMAWC	23.811	3
Others (219)		422.052	about 50
Total (229)		856.168	100

Source: FAO, 2010.

The wheat genetic pool includes modern and obsolete varieties and breeding lines, local populations, relatives, genetic and cytogenetic stocks. *The primary gene pool* includes genes of all forms which freely recombine with the cultivated species providing fertile hybrids. *The secondary gene pool* consists of genes of related species which express a certain degree of hybridization barriers (most commonly the species *Triticum* and *Aegilops*). *The tertiary gene pool* contains related species between which the gene transfer is extremely difficult because they do not cross with the cultivated wheat species (FAO, 2010). However, the boundaries between these groups are unclear and can be altered by technological changes (Ortiz et al., 2008).

State of maize genetic resources

Maize originates from the American continent, more specifically the southern and south-western parts of Mexico, where wild species related to maize (*Teosinte* and *Gamma grass*) can still be found. Crossed with maize, they provide hybrids (Goodman and Suketoshi, 2007). While maize is domesticated over wide geographical areas, the distribution of teosinte is significantly lower. It can be mainly found in the area of central and south-western Mexico, Guatemala and Nicaragua. As opposed to most cultivated crops, the ancestor of maize is not exactly known (Jevtić, 1996).

Economic significance of maize originates from the features of the plant itself, variety of its use and production volume. The primary use of maize is for animal food (around 78% of the total global production), but it is also used in human nutrition, primarily in developing countries, and in processing industries (for the production of semolina, flour, sugar substitutes, corn oil, starch, alcohol and whiskey) (Anđelković et al., 2017).

Today maize is cultivated on 194 million ha, which is by 83% more than in 1961, the year from which the FAO data for this crop originate. The largest area under maize is in America (37%), Asia (34%) and Europe (9%). In the previous decades, selection and breeding processes tripled the yield – from 1.9 t/ha in 1961 to 5.9 t/ha in 2018. Nowadays the total global maize production amounts to more than 1.1 billion tonnes (FAO database, 2018).

Maize germplasm conservation represents the main source of desirable genes which can increase the volume and quantity of maize production and consequently the food for people and animals. The dominant strategy for maize conservation is preserving the seed samples in genebanks. The germplasm in the collections consists of local populations (traditionally cultivated), varieties, lines, hybrids, and wild relatives.

The primary genetic pool includes the species of maize (*Zea mays*) and teosinte, with which maize can easily cross and create fertile hybrids. *The secondary genetic pool* consists of *Tripsicum* species (around 16 species). The variability between the local maize populations (around 300 identified species) is significantly higher than for any other crop, and it is related to the plant height, vegetation period, number of grains per ear, yield per hectare and the altitude favourable for its growth (FAO, 2010)

Maize collections are stored in 280 genebanks worldwide, while the total number of samples is estimated at over 300,000. The four largest global collections are held in CIMMYT in Mexico, BPGV-DRAEDM in Portugal, NC7 in the USA, and ICGR-CAAS in China, storing almost one third of maize germplasm. On the other hand, national collections are smaller but still vital for research and development (Table 3). In general, collections in America are significantly greater than those in the rest of the world.

Since there is a large number of genebanks preserving maize germplasm, Table 3 provides only those with more than ten thousand samples.

Table 3. Gene banks with the largest number of maize germplasm samples

Gene bank		**Samples**	
Name	Acronym	Number of samples	%
Centro Internacional de Mejoramiento de Maíz y Trigo	CIMMYT	26.596	8
Portuguese Bank of Plant Germplasm	BPGV-DRAEDM	24.529	7
North Central Regional Plant Introduction Station, United States Department of Agriculture, Agricultural Research Services	NC7	19.988	6
Institute of Crop Germplasm Resources, Chinese Academy of Agricultural Sciences	ICGR-CAAS	19.088	6
Programa Nacional de la Papa, Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias (Meksico)	INIFAP	14.067	4
N.I. Vavilov All-Russian Scientific Research Institute of Plant Industry (Russian Federation)	VIR	10.483	3
Others (275)		213.181	about 65
Total (281)		327.932	100

Source: FAO, 2010.

Out of the total number of 137,727 samples with the known germplasm type, wild relatives and local populations amount to 34%, while lines and modern varieties amount to 25%. This indicates that the interactions with the local environment have an important impact on creating germplasm variations within one species.

Security of stored material

A considerable number of PGRs is not stored under optimal conditions, which negatively affects the collection sustainability. The key limitations for the sustainability of the existing collections, recognized by the SoWPGR-2 (2010), are duplication and lack of regeneration of collections. It is estimated that out of the total sample number of 7.4 million, only a quarter represents distinct samples. Namely, the current system containing data and information on samples frequently makes it impossible to identify the same sample in different genebanks. Therefore, the existence and number of unnecessary duplicates cannot be determined. Similarly to other crops, numerous collections of wheat and maize germplasm are partly or completely duplicated. However, the greatest problem is the fact that the significant number of duplicates is not intended for a specific purpose, particularly regarding main crops, while the collections of other crops are inadequately duplicated.

Ageing of samples stored in genebanks occurs even under the optimal *ex situ* conditions. Therefore, monitoring the sustainability and timely regeneration of genetic material in the collections represents the crucial part of *ex situ* conservation. In this respect, key limiting factors are financial, infrastructural and human resources (FAO, 2010). Therefore, stronger efforts should be made at the national, regional and international levels in order to build adequate infrastructural capacities required for the sustainable *ex situ* conservation and management of PGRs for food and agriculture. Namely, a large number of countries do not possess suitable infrastructural and human capacities necessary for collection, maintenance, regeneration, characterization, documentation and distribution of PGRs according to the prescribed standards. Consequently, numerous collections are endangered since their storing and conservation are not conducted in the optimal manner.

Conclusion

Climate change and human activities have resulted in the impoverishment of biodiversity. It is estimated that ¾ of agro-biodiversity was lost only in the twentieth century and that the erosion is still ongoing. Thus, efforts are being made at the national and global level to preserve PGRs for food and agriculture for future generations and further research and development. Today, genetic resources are preserved in *in situ* and *ex situ* conditions, while the *ex situ* conservation is a dominant strategy for preservation of genetic materials.

There are more than 1,750 banks worldwide with approximately 7.4 million samples of genetic material of plant species significant for food and agriculture. According to the sample number, collections of cereals are the largest. Wheat, maize, rice, barley and oat comprise 35% of the germplasm stored in genebanks. However, it is estimated that only a quarter of the total sample number are distinct samples. Therefore, the most significant challenges in the future sustainable management of PGRs are the decrease of the number of duplicates and appropriate maintenance of collections. In order to improve the management system of PGR collections and encourage a wider use of germplasm, it is requisite to make more substantial investment in building the infrastructure and strengthening human resources. This will result in the global standardization and availability of data and information on PGR collections.

Literature

1. Anđelković, V., Babić, V., Kravić N. (2017): Genetički resursi u oplemenjivanju kukuruza, Selekcija i semenarstvo, Vol. XXIII, br. 1, str. 37-48;
2. European Communities (2007): Genetic resources in agriculture, A summary of the projects co-financed under Council Regulation (EC) No 1467/94 Community programme 1994–99 https://ec.europa.eu/agriculture/sites/agriculture/files/genetic-resources/publications/brochure_en.pdf;
3. FAO (2010): The Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture (SoWPGR-2). Rome;
4. FAO database, 2018, http://www.fao.org/faostat/en/#data/PP;
5. Goodman, M., Suketoshi, T. (2007). Background on the development of the: global strategy for the *Ex situ* conservation and utilization of maize germplasm. Global Crop Diversity Trust, CIMMYT.
6. Jevtić, S. (1996): Kukuruz, Monografija, Nolit, Beograd;
7. Loskutov, I.G. (1999): Vavilov and his institute, A history of the world col1ection of plant genetic resources in Russia, International Plant Genetic Resources Institute, Rome, Italy;
8. Ortiz, R., Braun, H.J., Crossa, J., et al. (2008): Wheat genetic resources enhancement by the International Maize and Wheat Improvement Center (CIMMYT), Genetic Resources and Crop Evolution 55 (7), pp. 1095-1140;
9. Pimentel, D., Harvey, C., Resosudarmo, P., Sinclair, K., Kurz, K., McNair, M., Crist, S., Shpritz, L., Fitton, L., Saffouri, R. and Blair, R. (1995): Environmental and economic costs of soil erosion and conservation benefits. Science 267, pp. 1117-1123;
10. Prodanović, S., Šurlan Momirović, G. (2006): Genetički resursi biljaka za organsku poloprivredu, Monografija, Poljoprivredni fakultet, Beograd;

11. Roljević S., Cvijanović D., Sarić R. (2011): Genetički resursi pšenice u svetu i Srbiji, Zbornik naučnih radova Instituta PKB Agroekonomik, vol. 17, br. 1-2, str. 27-33;
12. Sachs M.M. (2009): Cereal germplasm resources, Plant Physiol., vol. 149, pp. 148-151;
13. Securing crop diversity for sustainable development, forever, Crop Trust Pledging Conference, 2016, Washington, D.C., https://www.croptrust.org/resources/#fact-sheets ;

METHODS OF IMPLEMENTATION ENVISAGED IN THE RURAL DEVELOPMENT STRATEGIES IN THE REPUBLIC OF SERBIA

Svetozar Krstić[1]

Abstract

The paper analyzes the implementation of Rural Development Strategies for several typical municipalities from different regions of Serbia. The Republic of Serbia does not have a law on mandatory planning and adoption of strategic documents, due to the content and structure of strategic documents, the strategy of rural development included, and as the result of adopting the EU practice. The development and adoption of a significant development document is in itself a very large task and goal, but it is essentially a simpler part of the work in the adoption of rural development strategies. The harder part of the project is implementation, especially considering the need to articulate local needs and requirements of local participants, along with the need to coordinate the activities of a large number of participants. The starting point for the development and implementation of the Rural Development Strategy is a participatory approach, as well as the adoption and implementation of the "bottom-up" principle, with the active role of local participants.

Key words: *rural development, implementation, strategy, coordination, participants.*

Introduction

The aim of this paper is to consider the methods of implementation provided for in the Rural Development Strategies in the Republic of Serbia. As the Republic of Serbia does not have a law on mandatory planning and adoption of strategic documents, the content and structure of strategic documents, as well as the rural development strategy, are the result of taking over EU practice. In the EU, too, there is no single practice, but it is developed very often according to the requirements of individual programs or organizations. In the process of joining the European Union, Serbia has a pronounced need to raise the capacity of all participants in the process of rural development and create conditions for the application of public policies that are in line with policies, documents, standards and the Euro-

1 Svetozar Krstić, Ph.D., Assistant Professor, Metropolitan University, Faculty of Applied Ecology (Futura), Požeška Street no. 83/A, 11000 Belgrade, Serbia, E-mail: svetozar.krstic@futura.edu.rs

pean Union in the field of rural development. Experience so far teaches us that it is necessary to improve the management and efficiency of the implementation of all strategic documents, including those in the field of rural development. The author wants to emphasize the impact of good practices of consultants who provide services for drafting certain documents to local governments. It is important to point out, and this is precisely the idea of this paper, that in addition to creating rural development strategies in terms of content, it is equally important to anticipate and regulate the implementation of the Rural Development Strategy. The manner in which the rural development strategy is implemented, as well as the manner of control over the implementation of the Strategy are important preconditions for achieving the goals set out in the strategy. The paper uses domestic and international data sources, official reports of institutions and scientific papers in the subject area. Methods of analysis were applied in the preparation of the paper, through the analysis of Rural Development Strategies and other documents, and synthesis through synthesizing and linking the results.

Analyzing of the implementation

In the process of analyzing the implementation of the Rural Development Strategy, we decided on several typical municipalities from different regions of Serbia. We analyzed and processed the implementation of the Rural Development Strategy of the city-City of Novi Sad, city municipalities-City Municipality of Obrenovac, Municipality of Novi Becej from Vojvodina, Municipality of Trgoviste-Southern Serbia, Municipality of Dimitrovgrad-Southern Serbia.

It is necessary to emphasize that the development and adoption of a significant development document is in itself a very big task and goal. In essence, this is a simpler part of the job of adopting a Rural Development Strategy. "The issue of realization of such a document, ie coordination of all numerous activities and control of realization is much more complex, and therefore more responsible. Namely, it is about numerous direct and indirect participants in that realization, but also numerous objective, and often subjective circumstances (omissions and weaknesses) that occur in that process. The longer the period to which the document refers and in it implemented, its realization is more uncertain and complex. With that in mind, it is necessary to point out the role of individual structures and entities, as well as the possible way of avoiding mistakes, achieving the best possible results in the implementation of the Strategy." (Rural Development Strategies of the City Municipality of Obrenovac, Belgrade April 2012)

Implementation of the Rural Development Strategy of the Municipality of Obrenovac

Starting from the legally determined obligation of the municipality to adopt development programs, the City Municipality of Obrenovac adopted the Rural Development Strategy of the City Municipality of Obrenovac as a basic document for the development of the City Municipality. The implementation of the adopted Strategy is taken care of by all services in the Municipality, because it is a document that directs the overall socio-economic development in the next multi-year period. The authors of the Strategy decided on the great role of local communities in the implementation of certain parts of the Strategy, both in the organizational and in the implementation and control part. Among the analyzed Strategies, it is the only municipality in which the role of local communities is emphasized. It is emphasized that numerous participants will directly participate in the implementation of the Strategy, in addition to municipal services and local communities. These are, first of all, the bearers in making and realizing investment decisions, on which the degree and pace of realization of the Strategy largely depends. State bodies will also have an indirect participation, through professional and other assistance in the realization of certain segments of the Strategy. In order to implement an important document such as the Rural Development Strategy and to ensure the effective use of forces, it is necessary to ensure an optimal level of coordination. City Municipality of Obrenovac will have a key operational role in the implementation of the Strategy and projects of local socio-economic development and supervision over them, while the Council for the implementation of the Strategy, as an advisory body and decision-making body, will have overall responsibility at the level of sustainable rural development programs. The authors of the Strategy have decided to nominate a body that will be responsible for the implementation of programs and measures from the Strategy. The proposal of the author of the strategy is that the Council for the implementation of the Strategy consists of representatives of all relevant stakeholders, ie: Municipalities (local governments), local communities (local communities), civil society, public institutions, business associations and public associations.

The role of the Council for the implementation of the Strategy is as follows:

- approval of the Strategy of sustainable rural development of the City Municipality of Obrenovac;

- identification and definition of strategic commitments of sustainable rural development for City Municipality of Obrenovac;
- support for the institutional framework and implementation mechanisms established by national legislation;
- exchange of ideas and best practices;

The authors of the Strategy decided to implement the Strategy in accordance with the principles of project management, where, among other things, activities related to the appointment of a team for monitoring and implementation of the Strategy must be envisaged, as well as the formation of project teams for project implementation. The implementation of the Strategy will be done through the implementation of priority local projects of sustainable rural development approved by the Council for the implementation of the Strategy. City Municipality of Obrenovac also establishes the so-called Ad Hoc Committees-AHO, which includes the lead applicant, project partners and other stakeholders who can contribute to the preparation and implementation of projects. In order for the Strategy, as a comprehensive and complex program, to be successfully implemented, and the existing and potential forces to be used rationally, it is of great importance to ensure an appropriate level of coordination.

Supervision over the implementation of the Strategy is entrusted to the local government. The aim of the monitoring is to "establish the efficiency of the implementation and the resources used by the indicators defined at the appropriate levels". (Rural Development Strategy of the City Municipality of Obrenovac, Belgrade April 2012)

Implementation of the Rural Development Strategy of the Municipality of Novi Bečej 2015-2025

The Municipality of Novi Bečej and the authors of the Rural Development Strategy of the Municipality of Novi Bečej 2015-2025 opted for the LEADER approach. In achieving the LEADER approach, it is necessary to ensure an appropriate level of interest in active involvement in the LAG of the private sector by promoting the comparative advantages of this approach as well as significant financial benefits. It is necessary to provide the world with the need for cross-sectoral cooperation in which local actors act in a way that benefits everyone, and by adopting the LEADER approach lead to the achievement of sustainable development goals. rural development and is extremely well received throughout Europe (www.ec.europe.eu/Community-led local development) and is an example of good practice accepted in Europe and outside the EU. In order to achieve the strategic framework set by this Strategy it is necessary to start drafting an action plan as soon as possible, which would include the way of achieving priorities and define projects that contribute to the fulfillment of measures and activities.

The impact of the LAG's work should be reflected in providing preconditions for strengthening private sector initiatives that are important for rural development and that can significantly contribute, together with business and non-governmental sectors, to rural development, job creation and economic improvement.

Implementation of the Strategy for the Development of Agriculture and Rural Development of the City of Novi Sad 2018-2022

The implementation of the Strategy for the Development of Agriculture and Rural Development of the City of Novi Sad 2018-2022 is a very complex and demanding task. Implementation requires the learning of a number of direct and indirect entities, requires coordination and synergy of numerous activities, from adoption to implementation. By adopting and implementing annual plans, the Assembly gives full support to the implementation of the strategy. Also, through public companies founded by the City Assembly, it directly contributes to the implementation of the Strategy and the realization of its goals. In the process of implementing the Strategy, the city administration should mobilize all interested and relevant parties for the implementation of projects, in the field of rural projects, to convene meetings, provide information exchange, coordinate cooperation and provide all kinds of assistance to stakeholders in rural projects. Economic entities of various forms of organization, companies, cooperatives, clusters and individual agricultural farms should also play a significant role in the implementation. The role of the Ministry of Agriculture with its activities in providing predictable and stimulating support to rural development as well as the institutional arrangement of agriculture and rural development in accordance with the EU Common Agricultural Policy is also important in the implementation. The basis for further harmonization of policies and measures to support rural development is EU policy. It is emphasized that the implementation of the LEADER approach to rural development should play a very important role in the implementation of the Strategy. This will be achieved in particular through the formation of local action groups and local partnerships, related to improving the quality of life of the rural population, promoting local values and local products, as well as supporting development initiatives launched from the bottom up by farms, NGOs and representatives of civil society.

Implementation of the Rural Development Strategy of the Municipality of Trgovište 2014-2018

In the implementation of the Rural Development Strategy of the Municipality of Trgovište 2014-2018, the authors take the position that the state and its bodies are key to rural development. However, they accept the concept that local participants must play a key role in rural development. So, here the authors decided and applied an approach that respects the initiatives, needs and plans of the local community and which is supported and encouraged by the EU. The implementation phase is based on a combination of action plan, organizational structure and involvement of stakeholders. The implementation of the Strategy itself is a process in which all stakeholders must be involved, from the non-governmental sector, political leadership and all forms of economic entities. Implementation requires resources that need to be precisely determined when drafting planning documents.

The Strategy is updated, if necessary, through the annual adjustment of the action plan, and in case it is necessary to change the goals, then it is necessary to update the strategy. Having in mind the time period of validity of the Strategy, it is necessary to revise the Strategy every 3 to 5 years.

For the implementation of such a demanding document, the authors envisioned the education of three working bodies. First, the coordination body-team for monitoring the implementation of the Strategy. The team represents the working group for rural development of the municipality. The working group for rural development of the municipality includes 24 members, individuals and representatives of institutions from the municipality of Trgoviste. The main task of this working body is the annual monitoring of the degree of implementation of measures from the Strategy.

The working group for rural development of the municipality reviews the annual reports on the implementation of the Strategy and proposes corrective measures and activities for the continuation of the implementation of the Strategy. Secondly, the Strategy Implementation Group is formed, which is an operational body for the implementation of the Strategy and consists of project promoters, ie institutions that implement individual projects together with partners. The Strategy Implementation Group in cooperation with LED LED prepares and submits annual reports on the degree of implementation of the Strategy to the coordinating body. Project holders are in charge of: appointing a project manager, establishing a project team that includes representatives of the appointed partner organizations; preparatory activities that include resolving legal-property relations, preparation of project-technical investment documentation; project planning in annual budgets; promotion of projects with donors, preparation of applications for attracting additional sources of funding; conducting public procurement; monitoring the implementation of projects; reporting on project implementation. Thirdly, a Strategy Monitoring and Evaluation Team is formed. The mayor, the Municipal Council and the Municipal Assembly are in charge of monitoring, and the LED office of the Municipality of Trgoviste takes over this role operationally. In addition, LED is in charge of: supporting other departments of the Municipality, monitoring calls and financial lines for the implementation of the Strategy, project promotion, attracting donors, and at the same time providing technical support to the coordination body.

Rural Development Plan of the Municipality of Dimitrovgrad 2012-2022

The Rural Development Plan of the Municipality of Dimitrovgrad for the period 2012-2022 has all the features of the Rural Development Strategy of the municipality. The process of drafting and implementing the Plan is based on the participatory principle. The application of the principle of participation ensures the direct involvement of all stakeholders in the process of adoption and implementation throughout the period of validity of the Plan. The basic part of this organizational structure is the Coordination Team, which includes various departments. The coordination team is set up within the local administration, which allows it to coordinate the overall management and monitoring system. The formation of the coordination team was done at the very beginning of the work on the development of the Plan, by the appointment of the mayor. The responsibility of the coordination team is to integrate the Plan as a strategic document and the local action plan. The implementation of the Rural Development Plan is incorporated and uses the existing structure of local administration. The plan envisages the conclusion of partnership agreements for the implementation of goals and activities between stakeholders. Partnership agreements for the implementation of objectives and activities between different participants and stakeholders are approved and signed by the legal representatives responsible for the implementation of the objectives, as well as representatives of stakeholders involved in the implementation of activities. The implementation of the Plan itself takes place through a management system coordinated by the municipal administration, through an internal coordination team. An annual evaluation is performed to monitor the level of implementation of the local action plan, with an assessment of performance using sustainability indicators and performance indicators. The process of implementing the Plan itself must be considered and reviewed by all involved entities. It is this process of verification and review that encourages the sustainability of the system. By applying an annual monitoring cycle, it enables the updating of visions, priorities, goals and activities.

Conclusions

1. The common feature of all Rural Development Strategies is the attempt to develop Rural Development Strategies with a bottom-up approach, starting from the articulation of local interests, values and projects.
2. The process of drafting and implementing the Rural Development Strategy is based on the participatory principle, which ensures the direct involvement of all stakeholders in the process of adoption and implementation throughout the period of validity of the Strategy.
3. City and municipal authorities and municipal administration are involved in the implementation process of the Strategy, as key for the implementation.
4. Starting from the importance of the document, the large number of actors and the length of the deadline for the implementation of the Strategies, there is a clear awareness of the need for permanent work on the coordination of activities and actors of the Strategies. The Strategies envisage the formation of Councils and Coordination Bodies with different names for the coordination of activities related to the Strategy. In addition to coordination bodies, working bodies of lower level of organization are formed, such as implementation groups, monitoring teams.
5. During the development of the Rural Development Strategy, the LEADER approach was applied as an approach that ensures the involvement of local actors and represents a corrective for the alienation of local government. There is a strong awareness among authors and developers of the Strategy that when applying the LEADER approach it is necessary that partners participating in local action groups must be representative and able to participate in projects, and that through a proactive role it is necessary to animate and keep local partners active in projects. with a critical mass of resources, not only economic but also human resources, because in that way the sustainability of projects in the long run is ensured.
6. It is recommended to the Ministry in charge of rural development to make a special commitment to improving the adoption and implementation of Ru-

ral Development Strategies. Practices and representatives of the professional public and civil society, with the task of determining the proposed guidelines for the development of rural development strategies in the Republic of Serbia. In this way, conditions would be created for the harmonization of practices and standardization of activities related to rural development in the Republic of Serbia.

Literature

1. Agriculture and Rural Development Strategy 2014-2024 “Official Gazette of RS”, No. 85/2014.
2. National Program for Agriculture for the period 2018-2020, Official Gazette of the Republic of Serbia 120/2017.
3. Rural Development Strategies of the City Municipality of Obrenovac, Belgrade, April, 2012.
4. Rural Development Strategies of the Municipality of Novi Bečej 2015-2025, Novi Bečej, Jun,e 2015.
5. Strategy for the development of agriculture and rural development of the city of Novi Sad 2018-2022, January, 2018.
6. Rural Development Strategies of the Municipality of Trgovište 2014-2018, February, 20114.
7. Rural Development Plan of the Municipality of Dimitrovgrad 2012-2022, October, 2011

Internet source:

8. www.ec.europa.eu

IMPLEMENTATION OF THE LEADER APPROACH IN SERBIA: EXPERIENCES AND RESULTS

Vesna Paraušić[1]*, Bojana Bekić Šarić*[2]

Abstract

"Leader approach" and local public-private and civil territorial partnerships, in form of "Local action groups" aim toward the development of rural areas by using local initiatives, activities, potentials and needs (so-called „bottom up" approach) and by preparing and implementing local development strategies. This kind of approach toward the development of local rural communities has been present for a long time in rural politics and practice of most European countries. In Serbia, full legal basis to support implementation of this approach at national level has been established in 2019, and local stakeholders were not sufficiently informed with LEADER principles, especially in rural communities which were sparsely populated, poor and economically undeveloped. In the following years, one should expect the continuation of initiative support at national level, accreditation of LEADER measure into IPARD III Program, as well as larger role of local territorial partnerships in initiating development and improvement of quality of life in rural communities.

Key words: *Leader approach, LAG, rural development, Serbia.*

Introduction

Leader initiatives or Community Led Local Development (abbr. CLLD), which is implemented through activities of local action groups (abbr. LAGs), is the only program in which local communities have an important and central role in creating and realizing strategies of their territories (Leader achievements, 2020).

Leader approach for development of local communities has been introduced in EU in the beginning of nineties, as "Community Initiative Programme" and it was financed from the European structural funds. During the program period 2007-2013, Leader was an integral and mandatory part of CAP, i.e. EU rural development policy, financed from EAFRD (COUNCIL REGULATION

1 Vesna Paraušić, Ph.D., Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 697 28 58, E-mail: vesna_pa@iep.bg.ac.rs

2 Bojana Bekić Šarić, M.Sc., Expert Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 697 28 58, E-mail: bojana_b@iep.bg.ac.rs

EC, No 1698/2005), as well as from national rural development programs in EU countries. During the program period 2014-2020, its role and name in EU rural development policy was unchanged (Regulation EU, No 1305/2013), but this concept was applied on all European structural and investment funds, with unchanged title and wider understanding “Community-Led Local Development“ (Regulation EU No 1303/2013).

“Community-Led Local Development“(abbr. “CLLD”) has its focus on certain sub regional area. LAGs use it to incite not only local rural areas but also urban, fishing, coastal and peri-urban areas, and their mutual connecting, and it was tested also in areas outside EU, such as Western Balkans, Turkey, Georgia, Africa, Latin America and China (Leader achievements 2020; Regulation EU No 1303/2013).

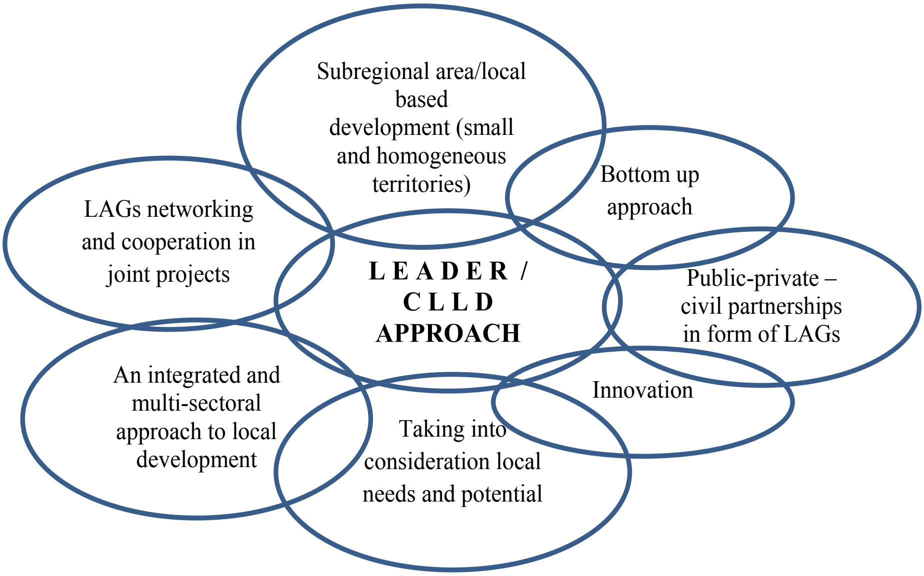
In the basis of Leader and CLLD approach is understanding, that, due to large diversity of rural communities, poor social and physical capital, low living standard and small population density, as well as other limitations of development, initiatives for local development and projects realization are most effective when lead by local actors/stakeholders.

Basic elements of LEADER – CLLD approach

Leader is the approach or the method of rural areas development by mobilizing and networking of local actors and realizing their initiatives and projects (EC, 2006; Council regulation EC No 1698/2005). Its goal is to contribute to sustainable social, economic and ecological development of local rural communities, i.e. to improve the standard of living, quality and conditions of living and employment in rural areas (Ibidem).

Correct understanding of LEADER approach for rural development, as well as CLLD approach for overall local development, depends on correct and comprehensive applying of their core features (Scheme 1).

Figure 1. Core features of Leader – CLLD approach



Source: Authors based on: Regulation (EU) No 1303/2013; EC, 2006; Council regulation (EC) No 1698/2005.

Leader approach is realized by LAGs, which are only ones competent to bring and implement local development strategies (abbr. LDS), to make decisions, realize ideas and projects, conduct allocation and manage financial, material and other resources in the community. This initiative started some 30 years ago, with about 200 initial pioneering LAGs in rural communities, and now there are over 3,000 LAGs in the ENRD LAG Database.

According to EC (EC, 1303, Article 32), "*LAGs are composed of representatives of public and private local socio-economic interests, in which, at the decision-making level neither public authorities, as defined in accordance with national rules, nor any single interest group represents more than 49 % of the voting rights*".

LAGs composition as defined for IPARD programmes is following: "*At the decision making level, the economic and social partners as well as other representatives of the civil society, such as farmers, rural women, young people and their associations must make up more than 50% of the partnership. Moreover, a minimum of 20% should be representatives of the local authorities. Women must be present at decision-making level*"(EC, 2017, p. 21).

LAGs are mostly registered as associations or foundations, although their legal frame depends on legislative framework of each country. According to Bogdanov (2007, p. 53), "LAGs have evolved into different legal formats in different countries – *limited companies in Ireland, non-profit consortia in Italy, inter-municipal associations and nature parks in France, but also co-operatives, associations and joint-stock companies in other parts of Europe"*.

Application of Leader approach in Serbia

Implementation of Leader approach in Serbia is under authority of the Ministry of Agriculture, Forestry and Water Management (abbr. MAFWM), department for rural development. Since 2019, by enactment of "Rulebook on incentives to support programs related to the preparation and implementation of local rural development strategies" ("Official Gazette of the RS", No 3/19), Serbia has full legislative and strategic frame for applying Leader approach according to EU demands, which consists of:

- ***"Law on Incentives in Agriculture and Rural Development"*** ("Official Gazette of the RS", No 10/13, 142/14, 103/15 and 101/16), which, within incentives for rural development measures, includes also support to programs for making and implementing LDS in rural areas.
- ***"The Strategy of Agriculture and Rural Development of the Republic of Serbia 2014–2024"*** ("Official Gazette of the RS", No 85/14) anticipates applying of Leader approach within the priority area 12 ("Improvement of social structure and strengthening of social capital") and operative goals ("Mobilization of local human and social potentials by organizing LAGs and LEADER approach" and "Promoting cooperative organization and inclusion of cooperatives into LAGs").
- ***"National Rural Development Programme 2018-2020"*** (abbr. NRDP) ("Official Gazette of the RS", No 60/18), anticipates the measure "Incentives for creating and implementation LDS in rural area". Measure is related to IPARD measure "Implementing LDS - LEADER approach", and complementary with IPARD measure "Diversification of agricultural holdings and business development", as well as with national measures in the field of rural economy diversification.
- ***"Rulebook on incentives to support programs related to the preparation and implementation of local rural development strategies*** " ("Official Gazette of the RS", No 3/19). Rulebook defines that MAFWM is financing

full expenses for creating LSD, and that the right to use incentives for LDS (financing small priority projects) has only the partnership with approved and payed assets for creating LDS. Rulebook, among other, states that: (a) "*the right to use incentives has the partnership founded in accordance to the Law on Associations and registered in the Serbian Business Registers Agency, as well as association of representatives of public, private and civil sector of a certain rural area*", (b) "*the area of partnership is coherent, geographically speaking continuous area, with population of more inhabited places, within territory of two or more units of local government, with at least 10,000, and the most 150,000 inhabitants; inhabited area within Partnership must not have more than 25,000 inhabitants*".

- ***IPARD II Programme 2014-2020 of the Republic of Serbia ("***Official Gazette of the RS", No 30/16, 84/17, 20/2019, 55/2019). So far, the implementation of Leader approach was not supported by IPARD. In the following period LAGs can expect the support through measure 9 "Technical assistance" (during the year 2020, EC officially approved accreditation of this measure), and in the later phase through measure 5 "Implementing LDS - LEADER approach" (accreditation of this measure is expected in IPARD III program for period 2021-2027); measure 9 foresees financial support for preparing, establishing and building of capacities and skills of potential LAGs, which later, as elected LAGs, could use financial assets of measure 5 (financing mini-projects, current LAG activities, involvement of LAG population, etc.); beneficiary of measure 9 is IPARD Managing Body, which is responsible for planning and promoting LEADER activities, while the beneficiaries of measure 5 are elected LAGs.

In Serbia, the beginning of Leader approach, or approach similar to this approach, goes back to year 2005, when MAFWM started to build the capacity of civil sector and established the cooperation with this sector in the field of rural development.

During the year 2010, the Network for Rural Development of Serbia was officially formed, which included regional offices for rural development, and in the previous period, large number of donor projects were realized from EC and MAFWM (TAIEX workshops), SWG, regional development agencies, Standing Conference of Towns and Municipalities, national experts, etc. (SWG, 2018; RDA 2017).

The important project which largely introduced the concept "Leader" into the rural development of Serbia was conducted during the period 2011-2013, within IPA support ("Leader initiative in Serbia", abbr. LIS). Through this project large number of local partnerships for territorial rural development were formed, of which about 20 were recognized as potential LAGs, such as: "Partnerstvo za razvoj Levča"; "Deliblatska peščara"; "Dolina jorgovana"; "Drina"; "Golija-Studenica"; "Podbrdska oaza", etc.

Besides that, the Government of AP Vojvodina, "Provincial Secretariat for Agriculture, Water Management and Forestry" (abbr. PSAWMF) continuously from 2013-2016 provided support to making territorial partnerships in rural areas, creating their LDS and realizing small priority projects (only at the territory of AP Vojvodina), with the main idea that these partnerships prepare and strengthen their capacities for incentives utilisation from the national budget, when the time comes. Partnerships supported from the provincial budged in 2016, were: "Tromeđa", "Gornji Tamiš", "Partnerstvo za Potamišje", "Srem IN", "Podbrdska oaza", and "Deliblatska peščara" (PSAWMF, 2016).

Although initially it was meant for LEADER approach in Serbia to be firstly supported by national measure (defined in NRDP), so that potential LAGs could be empowered to use „Implementing LDS - LEADER approach" - IPARD measure, there was a significant delay in bringing required rulebook. Because of that, Directorate for Agrarian Payments in 2019 announced the first public call for incentives for creation of potential partnerships and their LDS. The results of this call are going to be known at the end of 2020.

Considering that financial support of LAGs and Leader approach from the national support scheme, were not exist until 2020, and that there is a delay regarding accreditation of IPARD Leader measure, most partnerships which were formed through LIS project, or were supported from provincial budget, now do not work, or work with limited capacity, and the initial enthusiasm, entrepreneurial initiatives of the local stakeholders and social capital in the community was decreased. As stated in the SWG report (2018, p. 119), "*the previous experience with the establishing of LEADER support suggests that the activation and mobilization of local actors and creating their partnerships should start once the whole system is prepared and ready to handle this measure regularly; otherwise, there is a risk that the lack of continuity, consistency, transparency and sustainability in policy implementation can cause a loss of interest or confidence of actors*".

Conclusion

In Serbia, the concept and principles of Leader approach to rural development is still insufficiently understood by civil society organizations, representatives of local authorities, and other potential LAGs participants, and the knowledge and skills of local actors to form partnerships, create and realize LDS are at the low level. National support scheme for rural development took a long time to announce the public call for LAGs financing support, which led to blockage the initial progress regarding understanding and application of the Leader approach, and enthusiasm and initial commitment of representatives of the potential LAGs were gone (potential LAGs developed through LIS project in 2011-13 and those supported by the provincial government in 2013-16).

From the LAGs in Serbian rural areas in next period should be expected larger engagement in creating of LDS and realizing mini-projects, which could improve the quality of life in villages and which would be in accordance with priority needs of local population. That could be different projects, such as: support to creating village manifestations, renovating local objects (cultural, sports), creating pedestrian/cycling paths, children's parks, branding and promoting traditional local products and specialities, smaller investments in village tourism, etc. The beginning of LAGs work should be volunteering, partnerships should be led by optimistic and enthusiastic young people, which know foreign languages, have the right education, vision, plans, so that LAGs do not get formed only for incentives utilisation. From MAFWM one should expect to continue financial support from national level for implementing Leader approach, forming and working of LAGs, as well as intensifying activities related to IPARD III Leader measure.

Literature

1. Bogdanov, N. (2007): Small rural households in Serbia and rural non-farm economy. UNDP, Serbia, 2007.
2. COUNCIL REGULATION (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD).
3. EC (2017): Pathways to LEADER: A guide to getting the LEADER approach up and running in the Western Balkans, Turkey and beyond. European Commission, DG AGRI, October, 2017, available at link: https://enrd.ec.europa.eu/sites/enrd/files/enrd_publications/pathways-to-leader.pdf;

4. EC (2006): The Leader approach. A basic guide. Luxembourg: Office for Official Publications of the European Communities.
5. ENRD, LAG Database. Retrieved April, 10, 2020: from https://enrd.ec.europa.eu/leader-clld/lag-database_en
6. IPARD II Programme 2014-2020 of the Republic of Serbia, "Official Gazette of the RS", No 30/16, 84/17, 20/2019, 55/2019.
7. Law on Incentives in Agriculture and Rural Development, "Official Gazette of the RS", No 10/13, 142/14, 103/15 and 101/16.
8. Leader achievements (2020): Leader achievements, EU RURAL REVIEW No 29, 2020, ENRD/European Network for Rural Development.
9. National Rural Development Programme 2018-2020: "Official Gazette of the RS", No 60/18.
10. PSAWMF (2016): Results of the Competition on the conditions and manner of using incentive for the implementation of priority projects under the LIDER program in 2016 on the territory of AP Vojvodina, 12.12.2016. Retrieved May 25, 2020, from http://www.psp.vojvodina.gov.rs/upload/2016/Konkursi/2016_12_28_RezultatKonkurs_LAG.pdf
11. REGULATION (EU) No 1305/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL.
12. REGULATION (EU) No 1303/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL.
13. RDA (2017): Handbook for the application of the LEADER approach for the local rural development. Regional Development Agency "Braničevo-Podunavlje", February 2017.
14. Rulebook on incentives to support programs related to the preparation and implementation of local rural development strategies, „Official Gazette of the RS", No 3/19.
15. SWG (2018): Application of the LEADER Approach in the Western Balkan Countries - from a local initiative to a mainstream concept in the rural areas. Regional Rural Development Standing Working Group in SEE (SWG), North Macedonia, 2018.
16. The Strategy of Agriculture and Rural Development of the Republic of Serbia 2014–2024, "Official Gazette of the RS", No 85/14.

STATE AND DEVELOPMENT OF ORGANIC AGRICULTURE IN SERBIA

Vesna Popović[1], Branko Mihailović[2]

Abstract

The paper first contains a brief overview of the role of organic agriculture in the sustainable development and the state of the sector in the world and in the EU. The following is an analysis of the organic production structure and export results in Serbia and an assessment of the organic policy and legal framework in light of their harmonization with the EU. Priority measures for improvements within the organic sector are given in the conclusion.

Key words: *sustainable development, organic agriculture, organic area, producers and markets, organic policy and legislation, Serbia.*

Introduction

Research related to the planetary boundary framework has found that the levels of anthropogenic influences of four biophysical processes / features of the Earth's system (climate change, biosphere integrity, biogeochemical flows and land-system change) have exceeded the established limits. The last three have a strong regional dynamics, in particular, nitrogen and phosphorus that accumulate in the areas of intensive agriculture to affect the global nutrient flows. This allows redistributive measures to be taken to maintain the globally aggregated boundary value (Steffen et al., 2015).

According to the Report of the Food and Land Use Coalition (FOLU, 2019), the obligations arising from the 2030 Agenda for Sustainable Development and the Paris Agreement on Climate Change motivate people to build a new system of food and land use based on environmental protection and health, food security and social justice improvements. This assumes, inter alia, a large-scale shift to productive regenerative agriculture that, combining traditional production practices with advanced precision farming technologies and bio-based fertilizers and pesticides, moves sustainable agriculture from being "non-degrading"

1 Vesna Popović, Ph.D., Principal Research Fellow, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 697 28 54, E-mail: vesna_p@iep.bg.ac.rs

2 Branko Mihailović, Ph.D., Senior Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 697 28 42, E-mail: brankomih@neobee.net

to being "enhancing" (FOLU, 2019; Burgess et al., 2019). Organic agriculture belongs to the set of regenerative agricultural systems and practices (Ellen MacArthur Foundation and SYSTEMIQ, 2017; Burgess et al., 2019). Furthermore, according to the Rodale Institute (2020a, 2020b), based on three pillars (soil health, animal welfare and social justice), and committed to continuous innovation and improvements towards best practices across the set of sustainability dimensions, regenerative organic agriculture and related certification system go "beyond organic".

The FOLU position on the need to "scale regenerative farming practices, and gradually integrate them into mainstream agriculture to make it more sustainable" (FOLU, 2019), is in line with IFOAM and SOAAN Organic 3.0 concept that promotes "increasing adoption of organic principles in mainstream agriculture in order to improve global sustainability through growing the organic sector (certified and non-certified) while making it more sustainable". This strategy requires: innovation fostering, continuous progress towards best practice, multiple options to assure transparent integrity[3], building alliances for common sustainability goals[4], farm-to-consumer empowerment, and true value and cost accounting (Arbenz et al., 2016).

EU organic legislation defined organic production as "an overall system of farm management and food production that combines best environmental and climate action practices, a high level of biodiversity, the preservation of natural resources and the application of high animal welfare standards and high production standards in line with the demand of a growing number of consumers for products produced using natural substances and processes" (Reg. (EU) 2018/848).

Organic systems generate lower yields compared to conventional agriculture, but organic price premium results in greater profitability (Crowder, Reganold, 2015; Clark, Tilman, 2017). It is necessary to scale up certified organic production and short supply chains to secure a consumer-derived price premium (Burgess et al., 2019; Filipović et al., 2013; Popović, Mihailović, 2020), as well as organic research and innovations, and their dissemination and adoption (EIP-AGRI, 2013; Pérez-Ruíz et al., 2014; Röös et al., 2018).

According to FIBL and IFOAM 2018 data, there were 2.8 million organic producers in the world, of which in the EU almost 330,000, most in Italy (more than 69,000). A total of 71.5 million ha (1.5% of farmland) was organically managed,

3 Including participatory guarantee systems (PGS) for short supply food chains and alternative food networks (IFOAM, 2017, 2019).

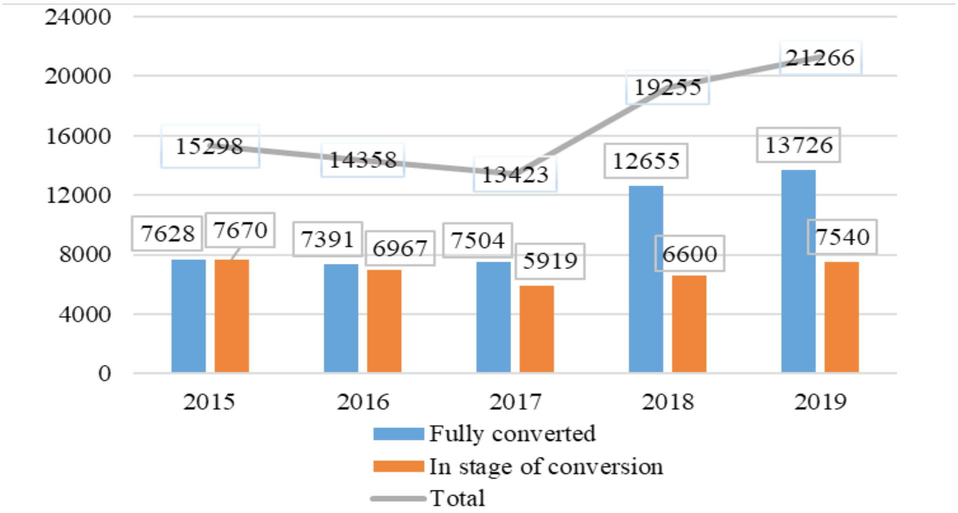
4 Potential allies include agroecology, fair trade, food sovereignty alliances, urban agriculture...

mostly in Australia (35.7 million ha). The organic area increased by 2.9% compared to 2017. Liechtenstein, Samoa and Austria were the countries with the largest share of organic area in total agricultural land (38.5%, 34.5% and 24.7%, respectively). A total of 13.8 million ha (7.7% of farmland) was organically managed in the EU, mostly in Spain, France and Italy. The organic land increased by 7.6% compared to 2017. In addition to Austria, eight other EU countries have a share of organic area in the agricultural land of more than 10% (Willer, Lernoud, 2020). One of the EU Farm to Fork Strategy objectives is to have at least 25% of the EU's agricultural land under organic farming by 2030 (EC, 2020a). The global organic market amounted to almost 97 billion euros, of which the US 40.6 billion euros and EU 37.4 billion euros. French organic market recorded the highest growth (15.4%). Expenditure on organic food per capita was highest in Denmark and Switzerland (312 euros). Denmark had the largest share of organic in the food market of 11.5%. In 2009-2018, EU organic market has more than doubled (Willer, Lernoud, 2020). Organic food consumption increased during Covid-19 lock-in in Europe, and retailers expect at least part of that increase be permanent (Escodo, 2020).

Organic agriculture in Serbia

Organic production has a tendency to grow. In 2019, 6,119 organic farming certificate holders and their associates were engaged in organic agriculture (SORS, 2020) as well as 21,266 ha of fully converted and in-conversion land (0.61% UAA compared to 0.44% in 2015) (Chart 1).

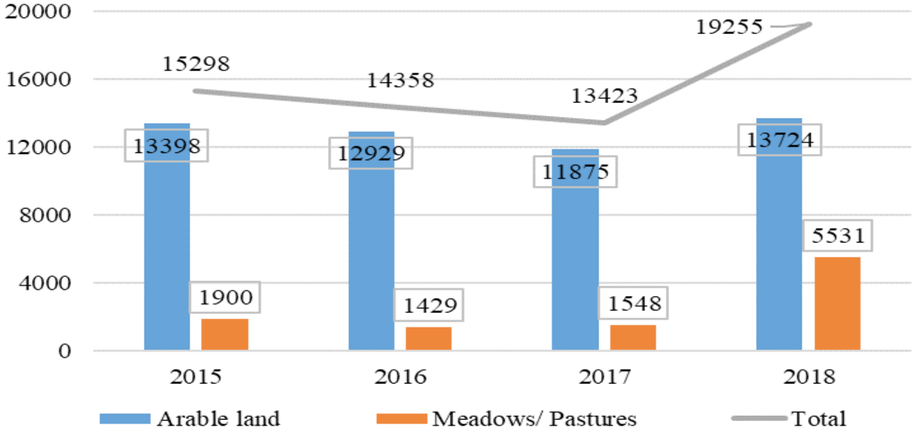
Figure 1. Organic land, 2015-2019. (ha)



Source: SORS, 2018, 2020.

After the decrease in 2016 and 2017, in 2018 the organic arable land[5] was increased, and significant areas of meadows and pastures were included in organic production[6] (Chart 2).

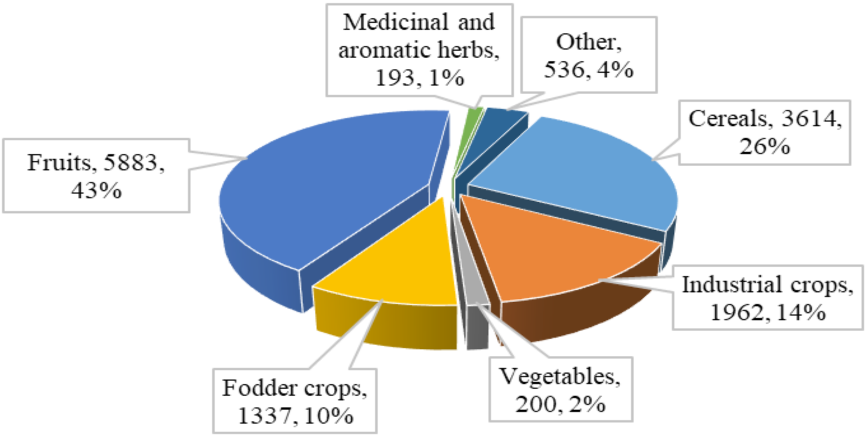
Figure 2. Organic land use, 2015-2018.



Source: MAFWM – DNRL, 2020.

The largest arable land in organic production in 2018 was occupied by fruits (43%), cereals (26%) and industrial crops (14%)[7] (Chart 3).

Figure 3. Organic arable land use (ha)



Source: MAFWM – DNRL, 2020.

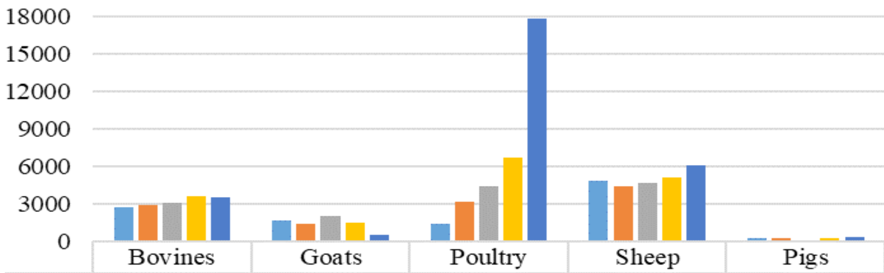
5 Arable land here in a broader sense (incl. permanent crops).
6 Data on organic land use in 2019 are not yet available.
7 According to the preliminary MAFWM data, the order is the same in 2019, but with partly different shares (fruits 33%, cereals 30%, industrial crops 14%) (Jovanović, 2020).

Climatic, relief, hydrological, geological and pedological features shape the spatial distribution of organic agriculture as well as types of farms and locally specific production practices, processing capacities, transport accessibility, market proximity, and eco-organic tourism potentials, especially within and around protected areas (Popović et al., 2011; El-Hage Scialabba, Williamson, 2004; Filipović et al, 2013; Popović, Mihailović, 2020).

The Region of Southern and Eastern Serbia had the largest share in the total organic area in 2018 of 45.3%, the Region of Vojvodina 31.0%, and the Region of Šumadija and Western Serbia 23.5%. Organic fruit production was usually performed on small family farms, integrated with non-certified crop and livestock production and covered by the group certificate, mainly in the Region of Šumadija and Western Serbia (59.4%), in the Kolubara, Mačva and Rasina districts, and in the Region of Southern and Eastern Serbia (36.7%), in the Toplica district. Cereals and industrial crops were mostly grown on farms specialized for organic field crops in the Region of Vojvodina (69.0% and 64.9%, respectively), in the South Banat and South Bačka districts, and in the Region of Southern and Eastern Serbia (26.5% and 33.7%), in the Zajecar district. Organic meadows and pastures are concentrated in the Region of Southern and Eastern Serbia (73.4%), in the Pirot district (MAFWM – DNRL, 2020).

Rise in organic livestock herds, which took place on larger farms with integrated organic fodder production, was recorded in 2015-2019, especially in the number of poultry, sheep and bovines (Chart 4).

Figure 4. Organic livestock, 2015-2019, number of animals



	Bovines	Goats	Poultry	Sheep	Pigs
2015	2746	1686	1380	4848	232
2016	2895	1406	3158	4378	283
2017	3094	2048	4415	4665	87
2018	3594	1486	6735	5138	284
2019	3556	536	17800	6099	315

2015 2016 2017 2018 2019

Source: SORS, 2020; MAFWM – DNRL, 2020.

According to the data for 2017, poultry (laying hens) was raised mainly in the Region of Šumadija and Western Serbia (58.8%), in the Zlatibor and Pomoravlje districts, and in the Region of Vojvodina (34.3%), in the South Banat district. The largest number of sheep was bred in the Region of Southern and Eastern Serbia (67.8%), in the Pirot district, and in the Region of Vojvodina (28.8%), in the North Bačka district, where the largest number of goats was also bred (70.5%). The Pirot district was the second area in the number of bovines in organic breeding (13.5%), after the South Bačka district of the Region of Vojvodina (69.9%), known for certified organic milk production[8] (MAFWM – DNRL, 2020).

Exports of organic products in 2018 amounted to 27.4 million euros, and it was dominated by frozen raspberries (58.1%), frozen blackberries (10.1%), apple concentrate (8.5%) and frozen cherries (5.6%). The largest share of exports was placed on the EU market, to Germany 27,1%, the Netherlands 12.7%, Austria 11.2%, and Italy 9.9% (MAFWM – DNRL, 2020).[9] The domestic market mainly consists of market niches of larger cities. Imports are dominated by processed products, which are sold through large retail chains.

Political and legislative framework

The unavailability of inputs and short length of the lease of state land for organic production, lack of storage capacities in vegetable production, low level of processing and inadequate packaging of fruits, lack of certified slaughterhouses and dairies in organic livestock production in southern Serbia and undeveloped short supply food chains are the main weaknesses of the organic sector (Simić, 2017; PPD for Development, 2018).

The goals of organic agriculture development (National RDP 2018-2020, Official Gazette of RS, 60/18) are aimed at solving these obstacles, primarily the goals related to: support for organic production as an integral part of national (and local) agricultural and RD programs and IPARD support; intensification of applied research in organics (including linkeage with EU organic research and innovation programs); and organic market development with emphasis on continuous adjustment of control and certification systems to EU standards, within the process of harmonization with the EU acquis.

8 Farma Organica, https://farmaorganica.rs/?lang=en.

9 According to Customs Administration, organic exports in 2019 amounted to 29.75 million euros and consisted mainly of frozen raspberries, apple concentrate, frozen blackberries and frozen cherries. More than a third of this value was realized in Germany (Vujanac, 2020).

The EU Regulation *on organic production and labeling of organic products* (2018/848), which will apply from 2022 (EC, 2020b), inter alia, provides for: strengthening and harmonization of production rules, phasing out a number of exceptions and derogations, strengthening the control system with stricter precautions and vigorous supply chain checks, extended list of organic products, a system of group certification for small farmers, and phasing out the system of unilateral equivalency in trade with third countries and shift the recognition of control bodies to the compliance regime. A new Action Plan on organic farming is expected in early 2021 (EC, 2020c).

System of control and certification of organic products in Serbia was harmonized with EU regulations (Simić, 2017), but further adjustments are needed (ECA, 2019). The new Rulebook *on control and certification in organic production and methods of organic production* (Official Gazette of RS, 95/20) regulates in more detail the control in organic production and corrective measures in case of irregularities. The Rulebook also regulates the organic production of wine and revises the list of active substances in plant protection products permitted for use in organic production, expanding the list of these products and increasing their availability. A new Law on organic production is expected by the end of 2021 (PPD for Development, 2020).

Conclusion

Having regard to the global strategic framework for organic agriculture and new organic legislation in the EU, growing demand for organic products on the world market and good production and market prospects, but also serious obstacles for organic operators in Serbia, the following priority measures for improvements within the sector stand out: continuous harmonization of the legislative framework for organic production with EU legislation; legislative and financial support to the production, processing, control and certification of organic products; and funding and promotion of organic research and innovation, and their dissemination and adoption, in order to increase productivity and market competitiveness. The promotion of group certification is particularly important for large number of smallholders. However, many of them, especially those in protected areas, tourist areas and urban agriculture remain outside the third-party certification and are not able to realize organic price premium. It is therefore necessary to strengthen short supply chains and alternative food networks, promote local partnerships and support the development of participatory guarantee systems.

Literature

1. Arbenz, M., Gould, D., Stopes, C. (2016): *Organic 3.0 – for truly sustainable farming and consumption*. IFOAM Organics International, Bonn and SOAAN, Bonn.
2. Burgess, P.J., Harris, J., Graves, A.R., Deeks, L.K. (2019): *Regenerative Agriculture: Identifying the Impact; Enabling the Potential*. Report for SYSTEMIQ. UK, Cranfield University.
3. Clark M., Tilman, D. (2017): *Comparative analysis of environmental impacts of agricultural production systems, agricultural input efficiency, and food choice*. Environmental Research Letters 12, 064016, https://doi.org/10.1088/1748-9326/aa6 cd5.
4. Crowder, D.W., Reganold, J.P. (2015): *Financial competitiveness of organic agriculture on a global scale*. PNAS, 112(24), 7611-7616.
5. EIP-AGRI Focus Group on Organic Farming. (2013): *Optimising Arable Yields. Recommendations and Outputs*. Final Report, https://ec.europa.eu/eip/agriculture/sites/agri-eip/files/fg1_organic_ farming_final_report_2013_en.pdf. (5.11.2020).
6. El-Hage Scialabba, N., Williamson, D. (2004): *The scope of organic agriculture, sustainable forest management and ecoforestry in protected area management*. Environment and Natural Resources Working Paper No. 18. Rome.
7. Ellen Macarthur Foundation and SYSTEMIQ. (2017): *Achieving "Growth Within"*, https://www.ellenmacarthurfoundation.org/publi cations/achieving-growth-within (7.11.2020).
8. Escodo, P. (2020): *Going beyond organic*, https://www.eurofresh-distribution.com/news/going-beyond-organic (6.11.2020).
9. European Commission. (2020a): *Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system*. COM(2020) 381 final.
10. European Commission. (2020b): *The future of organics. New legislation from 2022*, https://ec.europa.eu/info/food-farming-fisheries/farming/organic-farming/future-organics_en (18.11.2020).
11. European Commission. (2020c): *Action Plan for the development of EU organic production*. Roadmap. Ares(2020)4611911-04/09/2020.
12. European Court of Auditors – ECA. (2019): *The control system for organic products has improved, but some challenges remain*. Special Report No 4, Luxembourg.

13. Filipović, V., Popović, V., Subić. J. (2013): *Organic Agriculture and Sustainable Urban Development: The Belgrade – Novi Sad Metropolitan Area Case Study*. In M. Radović Marković, D. Vojteski Kljenak, D. Jovančević (Eds.), Employment, Education and Entrepreneurship − Rural Entrepreneurship: Opportunities and Challenges, 337-353. Belgrade, Faculty of Business Economics and Entrepreneurship.
14. IFOAM – Organics International. (2017): *The Full Diversity of Organic Agriculture: What We Call Organic*. Position Paper. Bonn Germany.
15. IFOAM – Organics International. (2019): *PGS Guidelines. How to Develop and Manage Participatory Guarantee Systems for Organic Agriculture*. Bonn, Germany.
16. Jovanović, M. (2020, 13 November): Increasing demand for organic products. Here's how to get the label "Organic" in Serbia. Biznis.rs, https://biznis.rs/vesti/sve-veca-potraznja-za-organskim-proizvodima-evo-kako-dobi ti-oznaku-organic-u-srbiji/ (15.11.2020).
17. Ministry of Agriculture, Forestry and Water Management. Directorate for national reference laboratories (MAFWM – DNRL). (2020): *Organic production in Serbia*, http://www.dnrl.minpolj.gov.rs/en/o_nama/organska/organska_proizvodnja_u_srbiji.html (14.11.2020).
18. *National Rural Development Program 2018 − 2020*: Official Gazette of RS, no. 60/2018.
19. *Organic Milk Farma Organica*, https://farmaorganica.rs/?lang=en (16.11.2020).
20. Perez-Ruiz, M., Slaughter, D.C., Fathallah, F.A., Gliever, C.J., Miller, B.J. (2014). *Co-robotic intra-row weed control system*. Biosystems Engineering, 126, 45-55.
21. Popović, V., Nikolić, M., Katić, B. (2011): *Use and Protection of Agricultural Land in Serbia*. IAE, Belgrade.
22. Popović, V., Mihailović. B. (2020): *Business Models for Urban Farming in and Around Urban Protected Areas: EkoPark Belgrade Case Study.* In A. J. Vasile, J. Subić, A. Grubor, D. Privitera (Eds), Handbook of Research on Agricultural Policy, Rural Development, and Entrepreneurship in Contemporary Economies, 89-107, IGI Global.
23. Public-private dialogue for development (PPD). (2018): *Info sheet - Dialogue on organic production*, https://www.jpd.rs/javno-privatni-dijalog-o-orgasnkoj-proizvodnji.php. (15.11.2020).
24. Public-private dialogue for development (PPD). (2020): *Development of organic agriculture through strengthening local support*, https://www.jpd.rs/razvoj-organske-poljoprivrede-kroz-ja%C4%8 Danje-podr%C5%A1ke-na-lokalu.php. (18.11.2020).

25. *Regulation (EU) 2018/848 of the European Parliament and of the Council on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007*. OJ L 150.
26. Rodale Institute (2020a): *Regenerative organic agriculture*, https://rodaleinstitute.org/why-organic/organic-basics/regenerative-organic-agriculture/ (5.11.2020).
27. Rodale Institute (2020b): *Framework for Regenerative Organic Certified™*, https://regenorganic.org/wp-content/uploads/2020/11/ ROC_Framework.pdf (5.11.2020).
28. Röös, E., Mie, A., Wivstad, M., Salomon, E., Johansson, B., Gunnarsson, S., Wallenbeck, A., Hoffmann, R., Nilsson, U., Sundberg, C., Watson, C.A. (2018): *Risks and opportunities of increasing yields in organic farming*. A review. Agronomy for Sustainable Development 38, 14.
29. *Rulebook on control and certification in organic production and methods of organic production*. Official Gazette of RS, 95/2020.
30. Simić, I. (2017): *Organic Agriculture in Serbia At a Glance 2017*. Serbia Organica, Belgrade.
31. Statistical Office of the Republic of Serbia (SORS). (2018): *Statistical Yearbook of the Republic of Serbia, 2018*.
32. Statistical Office of the Republic of Serbia (SORS). (2020): *Statistical Yearbook of the Republic of Serbia, 2020*.
33. Steffen, W., Richardson, K., Rockström, J., Cornell, S.E., Fetzer, I., Bennett, E.M., Biggs, R., Carpenter, S.R., de Vries, W., de Wit, C.A., Folke, C., Gerten, D., Heinke, J., Mace, G.M., Persson, L.M., Ramanathan, V., Reyers, B., Sörlin, S. (2015): *Planetary boundaries: Guiding human development on a changing planet*. Science 347(6223). DOI:10.1126/science.1259855.
34. The Food and Land Use Coalition (FOLU). (2019): *Growing Better: Ten Critical Transitions to Transform Food and Land Use*. The Global Consultation Report. https://www.foodandlandusecoalition. org/global-report/ (05.11.2020).
35. Vujanac, P. (2020, Jun 09): *Almost 95% of organic products in Serbia go for export, and there is a simple reason for that*. Blic, https://www. blic.rs/biznis/vesti/skoro-95-organskih-proizvoda-u-srbiji-ide-za-izvoz-a-za-to-postoji-jednostavan-razlog/x32txz9 (19.11.2020).
36. Willer, H., Lernoud, J. (Eds.) (2020): *The World of Organic Agriculture. Statistics and Emerging Trends 2020.* FiBL, IFOAM – Organics International.

IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE IN NATURAL RESOURCES MANAGEMENT IN PROTECTED AREAS

Viktor Radun[1], *Mirjana Bartula*[2]

Abstract

The enormous transformational power of AI and its radical and comprehensive impact find application in the field of natural resource management and ecosystem maintenance in protected areas. In this paper, we analyze the possibilities and challenges of the application of AI in protected areas, especially from the aspect of supporting the management of natural resources and achieving sustainability of ecosystems, which are of great importance for local socioeconomic development based on ecotourism.

Key words: *artificial intelligence, AI, ecotourism, protected areas, sustainability.*

Introduction

The application of Artificial Intelligence (AI), as one of the leading technologies within the Fourth Industrial Revolution, is gaining momentum and conquering various areas of the economy and society. The enormous transformational power of AI and its radical and comprehensive impact find application in the field of natural resource management and ecosystem maintenance in protected areas within ecotourism. In this paper, we analyze the possibilities and challenges of the application of AI in ecotourism, especially from the aspect of supporting the management of natural resources and achieving sustainability of ecosystems of protected areas, which are of great importance within ecotourism and the economy as a whole.

Importance of Artificial Intelligence (AI) as a key technology within the Fourth Industrial Revolution

Today's global economy is going through the new economic and technological transition caused by the Fourth industrial revolution (4IR) or Industry 4.0. The term „Fourth industrial revolution" is coined by Klaus Schwab, who in his seminal book *The Fourth industrial revolution* describes it as radical-

1 Viktor Radun, Ph.D., Assistant Professor, University Metropolitan, Faculty of Applied Ecology (Futura), Požeška Street no. 83/A, 11000 Belgrade, Serbia, E-mail: viktor.radun@futura.edu.rs

2 Mirjana Bartula, Ph.D., Associate Professor, University Metropolitan, Faculty of Applied Ecology (Futura), Požeška Street no. 83/A, 11000 Belgrade, Serbia, E-mail: mirjana.bartula@futura.edu.rs

ly different than the previous three industrial revolution. Comparing it with the third industrial revolution, he recognizes it as "the inexorable shift from simple digitization (the Third Industrial Revolution) to innovation based on combinations of technologies (the Fourth Industrial Revolution)" (World Economic Forum, 2016).

In fact, the 4IR is based on the new set of technologies capable of transforming business and society in a great many ways and on various levels. According to the Global Risks Report 2017, there are twelve emerging key technologies that make the technological foundation of the 4IR: a) 3D printing; b) Advanced materials and nanomaterials; c) AI and robotics; d) Biotechnologies; e) Energy capture, storage and transmission; f) Blockchain and distributed ledger; g) Geoingeneering; h) Internet of Things; i) Neurotechnologies; j) New computing technologies; k) Space technologies and l) Virtual and augmented Realities (World Economic Forum, 2017).

According to Radun (Radun, 2018) "The Fourth industrial revolution enables the connection and permeation of a wide range of new technologies and is a fusion or synthesis of many new scientific and technological fields." Artificial Intelligence (AI) is one of the fundamental technologies of the new competitive technological core of the 4IR. However, it is difficult to define AI properly, as it is not a single technology, but rather a set of various technologies and applications. The term AI is not so new, as it is coined in 1956 by computer scientist John McCarthy, who defined it as "the science and engineering of making intelligent machines, especially intelligent computer programs" (McCarthy 2007). According to Investopedia, AI is defined as "the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving" (Investopedia, 2020).

In the Deloitte's White Paper "Global Artificial Intelligence Industry", the value of the global AI market in 2019 is estimated as 1.90 trillion USD, and it "is likely to see phenomenal growth and achieve a market value of over USD 6 trillion by 2025 and a CAGR of 30% from 2017 to 2025" (Deloitte, 2019). AI is increasingly becoming ubiquitous technology and that is why it is hard to perceive it and evaluate its exact impact on the economy and various fields of society. The huge and disruptive impact of AI on economy and society is the result of these crucial characteristics: its all-embracing use (in various sectors of economy and society), interconnectivity, ability of self-learning and adaptability.

According to “The State of AI: Divergence, 2019” report, AI will likely to be “the fastest paradigm shift in technology history. In the course of three years, the proportion of enterprises with AI initiatives will have grown from one in 25 to one in three.” In the same report, the benefits of AI come down to four main ones: “innovation (new products and services); efficacy (perform tasks more effectively); velocity (complete tasks more quickly); and scalability (free activity from the constraints of human capacity)” (MMC Ventures, 2019).

Singh, Mishra & Sagar (Singh et al., 2013) state that AI consists of four main components: a) Expert systems; b) Heuristic problem solving; c) Natural Language Processing and d) Vision. Each of the named components may be structured further into a vast spectrum of distinct AI applications that find their practical use in various fields and sectors of economy and society. This corpus of AI applications is rapidly growing over time, becoming highly complex. Hence, any such attempt to exact defines and structure AI fields and applications seems to be problematic.

It is emphasized (Radun, 2019) that “the huge potential of AI in contributing to the improvement of performance, i.e. the growth of productivity, rationalization, business efficiency, rests on its *power of intelligent automation*. AI radically pushes the boundaries of automation and is able to make breakthroughs in various areas of the economy, automating and accelerating the way of collecting and analyzing data, business processes, ways of organization, decision-making, prediction capabilities, etc.”

The need of AI implementation in natural resources management in protected areas

AI is increasingly being used for addressing planetary environmental challenges. As Vinuesa et al. (Vinuesa et al., 2020) argue, AI applications may have both positive and negative impacts on sustainable development. In their study, they found that AI may significantly influence achieving 17 Sustainable Development Goals (SDGs) and 169 targets agreed in the 2030 Agenda, and discussed the implications of enabling or inhibiting meeting all 17 goals and 169 targets, classifying them into three groups: society, economy and environment. The study is very important as the authors discovered some contradictions and showed gaps in the research on the role of AI in facilitating sustainable development. Two important issues that demand further consideration are describes: a) the “self-interest can be expected to bias the AI research community and industry towards publishing positive results”, which they found “particularly apparent in the SDGs corresponding to the Environment group” and b) “discovering detrimental aspects of AI may require longer-term studies and, as mentioned above, there are not many established evaluation methodologies available to do so” (Vinuesa et al., 2020). The authors expressed concern that the research on AI without proper control, ethical and legal limitations may be directed towards AI applications where there are commercial interests or in fields potentially profitable. Hence, the risk of neglecting AI applications which use can enable achieving certain SDGs, if their commercial interests are not considered high. Therefore, the authors argue that it is “essential to promote the development of initiatives to assess the societal, ethical, legal, and environmental implications of new AI technologies” (Vinuesa et al., 2020).

AI applications can be used to collect, monitor process, analyze, manage and control the eco-environmental information. Acknowledging the rising importance of the AI application in eco-environmental modeling, Kim and Park (Kim & Park, 2009) performed the study in which they reviewed the previous studies that implemented AI techniques in eco-environmental modelling. They found that data mining is very useful data analysis tool, and “in data mining approach, particularly, artificial intelligence (AI) techniques (e.g., decision tree, artificial neural network, genetic algorithm, support vector machine, case-based reasoning and so far) facilitate ecological and environmental reasoning” (Kim & Park, 2009, p. 103).

AI can play an important role in improving efficiency in solving different environmental problems. For example, it can help improve the water quality by monitoring pollution levels in real-time to determine if any illegal activities are hampering the water quality, or to study animal behavioral patterns, such as migration, mating, and eating habits. Advanced AI and vision techniques help detect animals in pictures from cameras placed to track and study animal movements non-invasively (Joshi, 2019).

Taking into consideration the need of implementation of AI in natural resources management in protected areas, within the field of ecotourism, we stated that „as ecotourism promotes a sustainable, balanced, low-impact use of natural environment by consumers, it needs strategic approach, planning and developed legal framework that will guarantee its proper implementation” (Bartula & Radun, 2020). That is exactly the main cause of wider use of AI in ecotourism, in particular in visitor management planning and controlling illegal tourist movement outside tourist zones in the protected areas.

Application of AI can help to improve natural assets in protected areas faster and less expensive than by traditional management which is both time and money consuming.

Even though it has ratified all relevant international conventions and that its legislation is largely aligned with the European Union, Serbia is still not adequately protecting its natural heritage (Amidžić et al, 2013). The erosion of biodiversity is evident not only when it comes to species biodiversity, but also when it comes to ecosystem diversity (Amidžić et al, 2014).

Possibilities of application of AI in protected areas are primarily in the field of monitoring, measurement and conservation/protection. AI should provide automation of complex processes of management and maintenance of natural resources, biodiversity, standardization of measures and restrictions, as well as evaluation of the interactions of tourists and other users with natural resources within protected areas, in the direction of control and limitation, anticipation and prevention of possible harmful effects and actions anti-ecological behavior and activities of tourists within the protected area.

Writing on the role AI in the protection of the endangered species, E. Obluska (Ecoreactor, 2020) states: "Artificial intelligence can not only reduce the negative impact of human activities on nature, but also track the effects of species protection. AI is used, for example, to conduct non-invasive study of animal behavior patterns, such as migration, mating and eating habits."

Proposed model of the Smart AI-driven Knowledge Management System (SAIKMS) for managing sustainability of the protected areas

In the light of the above considerations, we are herewith presenting the model of the Smart AI-driven Knowledge Management System (SAIKMS) for managing sustainability of the protected areas. Such model should comprise the following components:

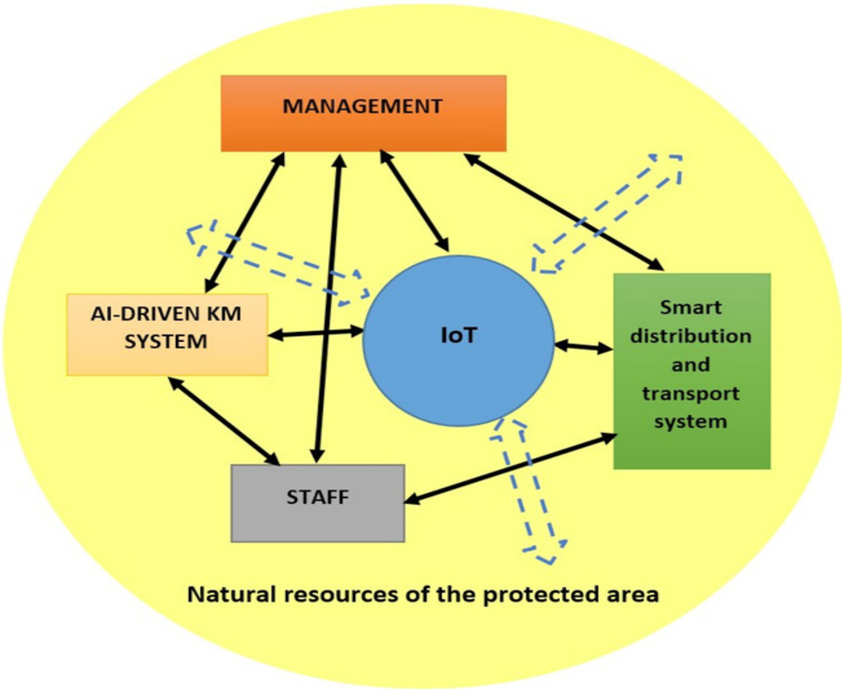
- **IoT infrastructure**, which consists of 4 main elements: sensors/devices; connecting with cloud infrastructure; processing data and user interface (see: Leverage, 2018). The role of IoT infrastructure is to collect various data on activities and changes within the defined zones and borders of the protected area.
- **Smart distribution and transport system,** consisting of network of AI applications for enabling sustainable and controlled tourism, including various services organized in the protected area. In this segment of the

model, the autonomous vehicles (AV) may be used, by which automation of transportation of tourists is attained and the natural resources and biodiversity in the protected area are preserved.

- **AI-driven KM System**, which is the system for creating, processing, analyzing, measuring, assessing, sharing and storing information and knowledge on activities, changes and variables of the relations and interactions within the protected area. This component involves human-machine interactions, using data management, analytics, expert systems, etc.
- **Management**, represented by managers who perform important responsible functions and operations, such as strategy formulation and evaluation, decision-making, regulation, marketing management, research and innovation management and control the operations and activities of both humans and devices/applications/utilities within the protected area.
- **Staff**, which includes all employees engaged in different jobs and sectors of the entire business and environmental ecosystem of the protected area.

The critical point of the model lays in the interaction among the three of the components described above – the management, IoT infrastructure and AI-driven KM System. The role of the management in the proposed model is crucial concerning the need to assess, control and make decisions upon the information and knowledge processed, analyzed and delivered by the AI-driven KM system, supported by the installed IoT infrastructure all along the protected area (Fig. 1). The management should be responsible for sustaining, managing and developing the complex dynamics of the ecosystems within the boundaries of the protected area, as it is the main attraction and subject of observing and exploring by the tourists who visit the protected area. However, it shouldn't be neglected the fact that the sustainability of the protected area is also of primary interest and the competence of the state which territory it occupies. So, the management should maintain the relations and connections with the local government as well as the national government, taking into consideration all important and relevant issues concerning the sustainable development both of the local and national level.

Figure 1. Model of the Smart AI-driven Knowledge Management System (SAIKMS) for managing sustainability of the protected areas



Conclusion

AI play important role in environmental protection in general and natural resources management in protected areas in particular.

Presented model of the Smart AI-driven Knowledge Management System enable sustainable management of protected areas by effective monitoring of biodiversity, processes in ecosystems, standardization of measures and restrictions, as well as evaluation of the interactions of tourists and other users with natural resources within protected areas.

Literature

1. Amidžić, L., Bartula, M., Krivošej, Z., Prodanović, D. (2013): Protected areas in Serbia. Natural Areas Journal Vol 33 (3): 348-355.
2. Amidžić, L., Bartula, M, Cvetković, D. (2014): The state of biodiversity in Serbia. Natural Areas Journal Vol. 34 (2): 222-226.

3. Bartula, M., Radun, V. (2020): Visitor management planning as a tool for sustainable tourism in protected areas in Serbia, 5th International Scientific Conference "Tourism in function of development of the Republic of Serbia", 3-5 September, 2020, Vrnjačka Banja, Serbia, Thematic Proceedings I, University of Kragujevac, Faculty of Hotel Management and Tourism in Vrnjačka Banja, Vrnjačka Banja, 2020.
4. Deloitte. 2019: *Global Artificial Intelligence Industry White Paper*. https://www2.deloitte.com/cn/en/pages/technology-media-and-telecommunications/articles/global-ai-development-white-paper.html
5. Ecoreactor. 2020: Obluska, E., Artificial intelligence in environmental protection, 15 May 2020, https://ecoreactor.org/en/artificia-inteligence-environmental-protection
6. Grand View Research. (2020): *Artificial Intelligence Market Size, Share & Trends Analysis Report By Solution* (*Hardware, Software, Services*), *By Technology* (Deep Learning, Machine Learning), Report Overview. Retrieved from https://www.grandviewresearch.com/industry-analysis/artificial-intelligence-ai-market (September 28, 2020)
7. Investopedia. 2020: Artificial Intelligence (AI). Frankenfield, J., https://www.investopedia.com/terms/a/artificial-intelligence-ai.asp
8. Investopedia. 2020: Artificial Intelligence (AI). Frankenfield, J., https://www.investopedia.com/terms/a/artificial-intelligence-ai.asp
9. Joshi N. (2019): How IoT And AI Can Enable Environmental Sustainability. Forbes. https://www.forbes.com/sites/cognitiveworld/2019/09/04/how-iot-and-ai-can-enable-environmental-sustainability/?sh=2886ba1468df (November 17.2020)
10. Kim, K. & Park, J. 2009: *A Survey of Applications of Artificial Intelligence Algorithms in Eco-environmental Modelling*, Environmental Engineering Research, June 2009, Vol. 14, No. 2, pp. 102~110, DOI: 10.4491/eer.2009.14.2.102. https://www.researchgate.net/publication/228784109_A_Survey_of_Applications_of_Artificial_Intelligence_Algorithms_in_Eco-environmental_Modelling
11. Leverege. 2018: How an IoT System Works, https://www.leverege.com/iot-ebook/how-iot-systems-work
12. McCarthy, J. 2007: "What is Artificial Intelligence?". Computer Science Department, Stanford University (Revised November 12, 2007), http://jmc.stanford.edu/articles/whatisai/whatisai.pdf, 06.03.2020.

13. MMC Ventures. 2019: The State of AI: Divergence, 2019. https://www.stateofai2019.com/
14. Radun, V. (2018): *Transhumanizam: Budućnost bez ljudi*, Pešić i sinovi, Beograd.
15. Radun, V. (2019): Opportunities and challenges of Artificial Intelligence in the transformation of economy and society in Serbia. *Limes Plus*, No.3/2019, 119-140. [*in Serbian*: Mogućnosti i izazovi Veštačke inteligencije u transformaciji ekonomije i društva u Srbiji. *Limes Plus*, No.3/2019, 110-140.]
16. Singh, G., Mishra, A., Sagar, D., An Overview of Artificial Intelligence, SBIT Journal of Sciences and Technology, Vol-2, issue 1, 2013.
17. Vinuesa, R., Azizpour, H., Leite, I., Balaam, M., Dignum, V., Domisch, S., Felländer, A., Langhans, S. D. Tegmark, M., Nerini F. F., *The role of artificial intelligence in achieving the Sustainable Development Goals*, January 2020, Nature Communications 11(1):233, DOI: 10.1038/s41467-019-14108-y, https://www.researchgate.net/publication/338554769_The_role_of_artificial_intelligence_in_achieving_the_Sustainable_Development_Goals/link/5e1c6dd692851c8364ca42f8/download
18. World Economic Forum. 2017: The Global Risks Report 2017, 12th Edition, http://www3.weforum.org/docs/GRR17_Report_web.pdf
19. World Economic Forum, Shchwab, K., The Fourth Industrial Revolution: what it means, how to respond, 14 January 2016, https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/
20. World Economic Forum. 2017. The Global Risks Report 2017, 12th Edition, http://www3.weforum.org/docs/GRR17_Report_web.pdf

SERBIAN AGRICULTURAL PRODUCTION IN THE CONDITIONS OF ITS ADAPTATION TO EU REQUIREMENTS[1]

Zoran Simonović[2], Nikola Ćurčić[3], Biljana Grujić Vučkovski[4]

Abstract

The aim of this paper is to present the agricultural production of Serbia in the conditions of its adjustment to the requirements of the EU, and in this paper, it will be observed many times. First, Serbia's agriculture must adapt to EU standards in order to place its products on the European market and be competitive. Secondly, competitiveness in the EU market is most easily achieved and maintained when farmers act together, with their form of organization and work based on modern standards. Thirdly, the authors believe that it would be easier for our farmers to market their products if they were produced in compliance with the requirements and principles of environmentally friendly production. The production of such food is becoming more and more represented on the world market and could be an export opportunity for our farmers.

Key words: *agricultural production, competitiveness, farmers associations, organic agriculture, EU.*

Introduction

Serbia's agricultural production is in conditions of adjustment to EU requirements to become its full member. *The Strategy of Agriculture and Rural Development of the Republic of Serbia for the period 2014-2024* by adopted. (Službeni glasnik RS, br. 85/14). Provides information on the planned activities that need to will carry in the agricultural sector. The initiator of the changes, also the bearer of the Strategy, by the Government of the Republic of Serbia, indicates in which direction agriculture would develop agricultural producers, represent the executors of the required requirements and principles.

1 Article is a part of research financed by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

2 Zoran Simonović, Ph.D., Senior Scientific Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 697 28 58, E-mail: zoki@medianis.net

3 Nikola Ćurčić. Ph.D., Scientific Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 697 28 58, E-mail: nikolacurcic@yahoo.com

4 Biljana Grujić Vučkovski, Ph.D., Scientific Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 697 28 58, E-mail: biljana_g@iep.bg.ac.rs

The adjustment of Serbian agricultural production on EU requirements can also by the angle of the joint appearance of our agricultural producers on the European market. As an example of a goods way of uniting farmers, fruit and vegetable growers by singled out because we believe that they have the best chances to become and remain competitive in the union market.

On the way to full membership in the EU, in the agricultural sector Serbian farmers should gradually reorient themselves to the introduction and application of the principles of environmentally friendly production. These changes are due to the increasingly demanding EU markets and necessary for the common, i.e. joint presence on the European market. By the way, organic agricultural products are also known as organic or biological products and often identified with the so-called by producing "*healthy food*." This type of agricultural production is complex than conventional and is gaining in importance. As such, they are recognizable in the EU market and can become competitive.

Agriculture development strategy in Serbia

The adoption of a strategy for the further development of agriculture, i.e. agricultural production, would significantly facilitate the further development of Serbian agriculture. The adoption strategy is inevitable at all levels of organizational production units in modern agriculture. The implementation is necessary at the same time to manage the risk and business opportunities offered by the market. Agriculture can be said to be a high-risk production area because there is a lot of uncertainty in business. In the world, agricultural production is much more influential than it is in Serbia. Hence, integrated production management by developed market economies is still considered a keys factor in increasing income and reducing risk. In that sense, the fact that there is no complete planning in one agricultural enterprise until the alternatives of the plan are included by inevitably emphasized. When looking for an answer to the question of what makes an agricultural enterprise competitive in any conditions, it should always be assuming that the strategy must provide alternative proposals for adapting production to all possible changes. They adopt strategies in large agricultural systems that have an impact on a large number of people through the prices, volume, and structure of goods sold by farmers, as well as expectations of return, namely, risk on the invested capital by investors. Consumers also are influenced by the price, quality, and variety of products. Thus, the strategy of these large firms differs significantly from that practiced by individual farmers. Many external factors influence the implementation of the development strategy. We are thinking of new market conditions caused by free-market principles. These principles are conditioned primarily by the EU requirements that the market of agricultural products in Serbia be opened and become easily accessible to EU countries.

Serbian farmers' associations on their way to the EU

Cooperatives, as one of the key stakeholders within the sector of agriculture have to actively support the strengthening of agricultural holdings in order to enable their easier approach at the local markets and realize available productions' surpluses (Simonović et al., 2012, p. 548). Nowadays, at national level cooperatives could be considered as highly real organizations, while majority of their members are trying to run the business activities in contemporary way, constantly thinking to fulfill actual commitments. Such a mentioned approach affects the Serbian cooperatives to experience the path to the upcoming business models (Simonović et al., 2016, p. 700).

Farmers' associations have an advisory, educational, and lobbying role and represent the first link of a "small" agricultural producer with all relevant institutions and organizations in the area: line ministry, scientific institutes, local economic development teams, domestic and foreign development agencies, NGOs and centers donor funds, etc. (Paraušić, 2018, 45).

Here, we primarily mean modern associations and cooperatives, whose bond is also the basis of a common for common interest, as well as providing a better life. The next step would be how much farmers can produce and thus their associations. The market must have listened. In our country, farmers have at their disposal a system of reporting on market conditions, which can indicate price trends, their values for certain types of vegetables in the off-season, the demand for certain varieties of kind of vegetables. Also, there is a way to explore what is in Europe, demand whether only the color of the product is still important while the taste is full on the sidelines or something has changed there as well. Namely, what helps farmers in Serbia, thanks to our climate, is the fact that large hypermarket chains in Europe are giving up products of colors and waxy appearance, which have such a taste, in favor of the full flavor of certain vegetable species. Of course, the appearance of the product by neglected, but it is no longer paramount.

What is very important, regardless of whether it is a market or sale in supermarkets, wholesale or retail, is the packaging and packaging of products, their calibration, and classification. A bar code label and a complete product ID card are also indispensable. Advancement of the certain cooperative is directly linked to the improvement of its agri-food products' quality, pointing to the successful transfer of modern tech-tech knowledge into its business activities (Simonović, 2014, p. 160). No needs to think about selling fresh produce any other way. Here should be emphasized one point. The started process of joining agriculture in the EU will touch every area of life and every activity in our country. The means that both trade and consumers, each in their domain, follow the same path.

The process of joining the EU for vegetable growers in Serbia means that they need to agree with their fellow producers to enter the market with as much calibrated and well-packaged product of the same quality which can be check over at any time. The farmer should not produce at the recommendations of his family already the request of the market and be always informed about new needs and requirements.

Ecologically acceptable agricultural production and possibilities of its development in Serbia

Ecologically acceptable agriculture includes tech-tech approach to the production that will not jeopardize the farm ambiance, while it is socially and economically admissible for the cultivation of plants and animals. It enables and helps the action of strongly expressed laws characteristic for the nature that will boost the productivity and resilience of grown crops and animals. This form of agricultural production seeks to create a mixed agricultural holdings consisting of two key elements: utilized land area (i.e. arable land, meadows and pastures, fruit plantations, gardens and vineyards) and grown animals. By this, it will be created the entirely harmonized farm, which is in the same time stabile and resistant to impacts outside the holding (e.g. environmental, socio-economic, etc.), (Simonović, 2014, p. 222).

Agricultural production that is environmentally essence is essentially production that uses manure and plant extracts instead of mineral fertilizers and pesticides. In this production, artificial fertilizers and pesticides by used more practically and professionally. This type of production cannot be considered ecological, but it can be a significant step towards its reorientation. Organic farming seeks to prevent the introduction of chemicals into the agro-ecological system. There is a real danger of getting a large number of diseases caused by eating unhealthy foods. (Schaer, at all, 2002, 9).

The fact is that organic farming has been growing around the world in recent years. The ecological, social, and economic crisis in which conventional agriculture has fallen is creating an increasing need in the markets for environmentally friendly products. Finally, this situation leads to a growing demand for agricultural products produced by the principles of organic production. The current situation in world agriculture shows that a request for quality food is continuously growing, especially in industrialized countries, while the production capacity of many areas by drastically reduced. (Tabaković, at all, 2017, 46).

Currently, on the Serbian food market, there is considerable uncertainty in determining products that carry the mark “Healthy food” or bring similar labels, which incorrectly mislead the customer that it is a product produced according to the standards of organic production. Think that our citizens are increasingly interested in using healthy food. On the other hand, producers abuse this situation for their material gain, for the simple reason that the products of organic agriculture on the market are 20% to 80% more expensive by the production of conventional agriculture. (Sredojević, 2002, 130).

We hope that this situation will change with the adoption of the amended Law on Organic Production (Službeni glasnik RS, br. 30/10 i 17/19), which first came into force in 2011. This Law regulates the production of agricultural products obtained by ecological methods, i.e. organic production, determines the goals, principles, way, control, labeling, storage, transport, trade, import and export of organic products, as well as other issues of importance for organic production. (Simonović, 2014, 223).

The current situation in world agriculture shows that the demand for quality food is permanently growing, especially in industrialized countries, while the production capacity of many areas is decreasing. Субић, Бекић, & Јелочник, 2010, 51).

There are more and more demands coming from the international market of agricultural products that require the production of high-quality health-safe food. Starr, at all, (2003, 305). There is great potential for the production of such food in Serbia. For that reason, the agri-food industry should focus on such.

The current situation in Serbia indicates that there is no interest in ecological agricultural programs. An exception to this attitude exists in by certain regulation protected areas that correspond to their natural values. Preservation of the environmental reserves is affected by agricultural practice established through ecological programs. It means that this policy highly correlates to the used EU policies, as the running of agri-environmental programs represents the obliged segment of accession process to the EU, precisely considered by the CAP. Demand for organic food products is becoming severely determined by consumer awareness of their quality. The part of market turned to organic food products will become one of the rapidly grown sectors, represented worldwide, especially in the EU (Türk, Erciş, 2017, p. 195).

Conclusion

By modern agricultural production must be based on meeting the needs and desires of consumers while respecting innovation. Also, the products must have a certain quality while achieving a high degree of food hygiene and respecting food safety standards.

Further development agriculture would be based on natural potentials, demand that absorbs most of the domestic production, demand dynamics in the world as well as on existing processing capacities that need by reconstructed and modernized and establish price competitiveness for the most important export products.

In order to implement the previously mentioned activities, is strong and aggressive marketing at the individual and collective level is necessary, along with the development of cooperation with farmers and associations of agricultural producers. The products of the agricultural sector obtained in this way would meet high standards of food quality and safety with optimal use of capacity.

By meeting these requirements, the agricultural sector of Serbia could be recognizable by-products with a protected geographical indication, with a designation of origin and products based on traditional recipes. (Ministry of agriculture, forestry and water management, 2010).

Literature

1. Ministarstvo poljoprivrede, šumarstva i vodoprivrede (2010): Strategija poljoprivrede i ruralnog razvoja za period od 2010 do 2020, 19.
2. Paraušić, V. (2018): Značaj i uloga udruženja poljoprivrednika u Srbiji. Časopis Agroekonomika, 47(80), 43-51.
3. Prodanović, R., Kuzman, B., Jovović, D., & Ozegović, L. (2017): Market and trade of organic fruits in Serbia. *Economics of Agriculture*, *64*(1), 141-155.
4. Schaer, B., Strauch, C., & Knickel, K. (2002): Marketing Sustainable Agriculture: An analysis of the potential role of new food supply chains in sustainable rural development. *Sus-Chain, QLK5–CT–2002–01349*.
5. Simonović, Z., Hamović, V., Mihailović, B. (2012): Zadaci agrarne politike u harmonizaciji i pružanju interne podrške poljoprivredi Srbije, str. 547-556, Međunarodna naučna konferencija: Harmonizacija zakonodavstva Republike Srbije sa pravom Evropske Unije II, Institut za međunarodnu politiku i privredu, Institut za uporedno pravo.

6. Simonović, Z. (2014): Upravljanje agrarom Srbije u tranziciji. *Institut za ekonomiku poljoprivrede, Beograd*.
7. Simonović Z, Mihailović B, Milovanović Z. (2016): Cooperatives and farmers association as a model of entrepreneurship in Serbian agriculture regarding the case of Nišava district. Economic of Agriculture; 63(2): 699-712.
8. Sredojević Z. (2002): Ekonomski problemi ekološke poljoprivrede, Poljoprivredni fakultet, Beograd, 130.
9. Starr, A., Card, A., Benepe, C., Auld, G., Lamm, D., Smith, K., & Wilken, K. (2003): Sustaining local agriculture barriers and opportunities to direct marketing between farms and restaurants in Colorado. *Agriculture and Human Values*, *20*(3), 301-321.
10. Službeni glasnik RS, br. 85/14, Strategija poljoprivrede i ruralnog razvoja Republike Srbije za period 2014-2024. Godine
11. Službeni glasnik RS, br. 30/10 i 17/19 – dr. zakon., Zakon o organskoj proizvodnji
12. Subić, J., Bekić, B., & Jeločnik, M. (2010): Značaj organske poljoprivrede u zaštiti okoline i savremenoj proizvodnji hrane. Škola biznisa, 3, 50-56.
13. Tabaković, M., Simić, M., Dragičević, V., & Brankov, M. (2017): Organska poljoprivreda u Srbiji. Selekcija i semenarstvo, 23(2), 45-53.
14. Türk, B., & Erciş, A. (2017): Uticaj 4A marketing miksa na tendencije kupovine organske hrane. *Serbian Journal of Management*, 12(2), 189-199.

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

631:502.121.1(082)(0.034.2)
005.591.6:631(082)(0.034.2)
338.432(082)(0.034.2)

INTERNATIONAL scientific conference Sustainable agriculture and rural development (2020 ; Beograd)
Thematic proceedings [Elektronski izvor] / International scientific conference Sustainable agriculture and rural development, [December, 17-18, 2020], Belgrade ; [organizers] Institute of Agricultural Economics ... [et al.] ; [editors Jonel Subić, Predrag Vuković, Jean Vasile Andrei]. - Belgrade : Institute of Agricultural Economics, 2021 (Novi Sad : Mala knjiga). - 1 elektronski optički disk (CD-ROM) ; 12 cm

Tiraž 300. - Preface / editors. - Napomene i bibliografske reference uz tekst. - Bibliografija uz svaki rad.

ISBN 978-86-6269-096-8

1. Subić, Jonel, 1964- [уредник]
а) Пољопривреда -- Научно-технолошки развој -- Зборници б) Пољопривреда -- Одрживи развој -- Зборници в) Пољопривредна производња -- Зборници г) Рурални развој -- Зборници

COBISS.SR-ID 32097033

9 788662 690968