INSTITUTE OF AGRICULTURAL ECONOMICS, BELGRADE, SERBIA

SUSTAINABLE AGRICULTURE AND RURAL DEVELOPMENT IN TERMS OF THE REPUBLIC OF SERBIA STRATEGIC GOALS REALIZATION WITHIN THE DANUBE REGION

- sustainability and multifunctionality -

Thematic Proceedings

Belgrade, 2019

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

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Jonel Subić, Ph.D.
Marko Jeločnik, Ph.D.
Boris Kuzman, Ph.D.
Jean Vasile Andrei, Ph.D.

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Biljana Grujić, Ph.D., Predrag Vuković, Ph.D.,
Lana Nastić, Ph.D. & Vladimir Sokolović

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INTRODUCTION OF ALTERNATIVE OIL PLANTS IN PRODUCTION ON SMALL FARMS

Nenad Đurić[1], Marija Spasić[2]

Abstract

According to research results to date, under our agroecological conditions alternative oil plants can be successfully grown in flatlands and hilly regions up to 500 m altitudes. The six described plant species (safflower, false flax, castor bean, oil poppy, cucurbita and linseed), although they belong to different families, have the common characteristic that they contain over 40% of oils in their fruits or seeds. These plant species utilize water rationally, have xeromorphic characteristics and tolerate draught, i.e. elevated temperatures resulting from global warming. Production costs compared with realized yield and the price for the obtained grain, give a gross financial result higher than for most agricultural crops grown on larger surfaces, from 54,000 dinars per hectare for false flax production, to 209,250 dinars per hectare for oil poppy production. The financial result is in fact even better if the value of byproducts is also taken into account; therefore, it is fully justified to recommend to our farmers to designate certain areas for growing these alternative oil species.

Key words: *alternative oil plants, safflower, false flax, castor bean, oil poppy, linseed, production.*

Introduction

Alternative oil plants are a group of agricultural crops interesting for growing in a system of sustainable and organic production on small areas (Đurić et al., 2015). In the Republic of Serbia, farmers grow most of these plants on infields, most often using their products for own needs or for sale on the local market.

1 Nenad Djuric, Ph.D., Assistant Professor, Megatrend University, Faculty of Biofarming, Maršala Tita 39, 24300 Bačka Topola, Serbia, Phone: +381 62 803 53 60, E-mail: nenad.djuric@outlook. com

2 Marija Spasic, Ph.D., Research Associate, associate on the project III 46006, Serbia, Phone: +381 64 88 034 12, E-mail: mrmarija.spasic@gmail. com

An analysis of the volume of crop production and insight into the structure of planting of field crops in general shows the evident interest of individual farmers to grow plant species that are new in this region or plants the production of which has been almost extinguished during the past decades (Prijić et al., 2003).

Today, there are several small associations of producers of oil poppy, cucurbita and linseed, bringing together our selection companies, agricultural expert services and institutions working on the study and processing of productive organs of such plants, as well as offering services such as lectures, brochure preparation and organizing events dealing with agricultural production (Glamočlija et al., 2010; Filipović et al., 2014; Glamočlija et al., 2016; Popović et al., 2017; Đurić et al., 2018; Glamočlija et al., 2018).

Biology and economic importance

Following species belong to the group of alternative oil plants that can be grown under agroecological conditions in Serbia: safflower, false flax, castor bean, oil poppy, cucurbita and linseed. These species belong to different botanical families, but have the common characteristic that they synthesize and accumulate large quantities of oil containing vitamins D, E and K in their seeds and fruits. As for nutrients, the second place is held by proteins, therefore these species can conditionally also be called oil-protein plants.

Safflower (*Carthamus tinctorius* L.) is an annual species belonging to the *Asteraceae* family. During the vegetation period lasting 110-140 days plants develop a strong spindle shaped root system and an upright sturdy and branching stem up to 200 cm tall. Leaves are small, oval-elongated, leathery, pointed, with pronounced xeromorphic structure. Branch tips develop flower heads with yellow or red flowers along the edges. A flower head contains 20-100 bisexual tubular flowers. The plant is pollinated by bees, and the fruit is an achenium containing one seed, similar to the fruit of the sunflower. It is firmly enveloped in a pericarpium, representing 25-35% of the seed. The fruit contains 35-48% oil, 15-25% total proteins, 22-26% carbohydrates and 2-3% mineral salts. Creation of new species is in several directions. The first is to obtain varieties with an elevated content of certain fatty acids. Current linolene type varieties have a high content of this omega-6 fatty acid and produce very valued edible oil. In addition, oil is an important industrial raw material for manufacturing lubricants, bio fuels and agents for personal hygiene. Depending on the manner of extracting oils, oil cakes can be used as concentrated

feed (Kholer et al., 1996) or raw material for further industrial processing. Varieties with low oil content, but high protein content and a thin pericarpium are used as feed for poultry and caged birds, while very branching varieties with large leaves are used for feed via biomass grazing or mowing (Landau et al., 2004).

False flax (*Camelina sativa* Cr.) is an annual plant belonging to the *Brassicaceae* family. It was introduced in crop production in Germany and Russia after upgrading indigenous species spontaneously growing on large areas in fields of Europe and Central Asia, often as weeds (Sampath, 2009). According to the time of planting, it can be a spring and a winter crop, with a vegetation period of 70-100 days, i.e. 240-250 days. Winter forms pass the winter as leaf rosettes (Glamočlija, 2010). It develops a spindle shaped root system with huge suction power. The stem is upright, branching, 30-80 cm tall, covered in small simple leaves that dry during the maturing of the plant. Flowers are on flower branches of 10-30 cm. They are bisexual, with light yellow crowns. They are pollinated by insects. The fruit is a spear-like husk of up to 1 cm, divided into two chambers containing up to 10 small oval-elongated yellow-red seeds. As stated by Zubr (2003), seeds contain 30-45% oil with a dominance of unsaturated fatty acids (omega-3 and omega-6). In quantity, oils are followed by proteins (25-30%), carbohydrates (approx. 20%) and mineral salts (1.5-2. 5%). False flax is pre dominantly grown as an oil plant. Its oil belongs to the group of best quality edible oils and is used in preparing functional foods. Technical oil is used in the cosmetics industry (Crouzier, 2005) and to manufacture fine bio lubricants and biofuels (Jeromela et al., 2016). In arid regions, false flax is a valued crop adequate for grazing domestic animals. Remnants after seed processing and harvest remnants can be used as forage for domestic animals (Flachowsky et al., 1997).

Castor bean (*Ricinus comunnis* L.) is a species belonging to the *Euphorbiaceae* family. It originates from tropical regions of Africa, where it was cultivated some 6,000 years ago. Today there are annual forms grown in the temperate climate belt and perennial bushes in tropical and subtropical regions. During a vegetation period, lasting 120-140 days, the plant develops a strong, deep spindle shaped root system with great suction power. The stem grows during the entire vegetation season and can grow up to 13 m. In selected varieties, the stem has limited growth, reaching up to 2-3 m. It branches abundantly, and is covered in large ball-shaped leaves with long stems. Branch tips develop flower branches, approximately 50 cm long, with male flowers in the lower, and female flowers in the upper section of the flower head (Glamočlija, 2010). Pollen is transferred by wind. The entire

plant has a pronounced xenomorphic structure, covered on the surface with a wax layer. The fruit is a ball-shaped to elongated cocoon containing three seeds, with a pericarpal surface naked and smooth in selected varieties, and covered in solid spines in unselected populations. The seed is large, oval-elongated, mosaically mottled. It is enveloped in a firm smooth envelope, making up to 25% of the total seed mass (Oplinger et al., 2018). The seed contains 55-60% oil, approximately 24% total proteins, approximately 25% carbohydrates and approximately 4% mineral salts. In addition to decorative forms grown in parks, modern annual varieties of castor bean are produced for their oil rich seeds. Unrefined oil is very toxic because it contains ricin and RCA protein. Oil obtained by cold pressing is used in the pharmaceutical and cosmetics industries, and can also be used as edible oil if toxic substances are removed by a complex refining process. When oil is extracted by a warm procedure, it is used in the textile and leather industry, for manufacturing motor oil, or as liquid biofuel. Oil cakes are raw material for further industrial processing, and if toxic substances are removed, they can also be used as animal feed (Rao et al., 1984).

Oil poppy (*Papaver somniferum* L.) belongs to the *Papavreaceae* family. It originates from wild species introduced into production by peoples of Asia Minor, and approximately 3,000 years ago growing expanded to Europe and the entire Asian continent (Bernáth, 1998). This plant species is adapted to conditions of occasional and abundant precipitation by having roots spread out in the surface layer, even though the root system is spindle shaped. The stem is upright, brittle and easily broken, in the initial phases of growth herbaceous, later becoming woody. Lateral branches develop in the upper section of the stem. The poppy develops large elliptical leaves clasping the stem. The entire plant is coated in a wax layer giving it a blue-green color. Large bisexual flowers of prominent colors are on the tips of lateral branches, the plant is self-pollinating and cross-pollinating. The fruit is a conical, ball shaped or oval cocoon containing several seeds, which does not burst when ripe. Plants mature rather uniformly, which can be recognized by the drying of leaves and the separation of seeds from the placenta (Popović et al., 2017). Productive organ of the oil poppy, the seed, contains 55-60% oil, approximately 25% total proteins, 20-25% total sugars and 2-4% mineral salts. Cold pressing produces quality edible oil, light colored and with a pleasant aroma (Popović et al., 2018). The warm process produces technical oil used in cosmetics and the chemical industry to produce painting colors, varnishes and other agents for wood protection. Oil cakes are used as concentrated animal feeds (Statham, 1984; Küçükersan et al., 2009). Dry harvest remnants are appropriate as fuel for heating residential buildings and economic structures on farms.

Cucurbita (*Cucurbita pepo* L. *var. styriaca*) is an annual plant belonging to the *Cucurbitaceae* family. It is a natural mutant of summer squash *(Cucurbita pepo* L. *var. pepo)* which first appeared in Austria (Glamočlija, 2006). Depending on the original variety, there is a difference in seed structure, where it does not have a firm envelope, but a thin and delicate greenish envelope. The vegetation period of cucurbita lasts 90-130 days. Plants develop a spindle shaped root system with the majority of roots in the surface layer of the soil. The stem is creeping, with few branches, covered in short thorns, and is up to 10 m long (Berenji, 2010). Large heart-shaped leaves on long stalks develop on the stem. Leaves are serrated along the edges and covered in rough hairs. Unisexual flowers are formed on plants, and are pollinated by insects. The fruit is a large and fleshy berry with an average weight of 2-4 kg. The thick firm green-yellow outer wall covers an orange fleshy layer, with a placenta in its interior where egg-like flat seeds are formed. They have thin envelope covering the cotyledons and germ. Nutrients, oils (45-48%), total protein (30-40%), total sugar (15-20%) and mineral salts (approximately 2%), are located in the germ. The seed is the main product and is used to obtain edible oil extracted using cold pressing or solvents. Oil content is approximately 45% linolenic, 25% oleic, 30% palmitic and very little saturated stearic acid. Pressing produces higher quality oil, because it also retains other useful substances, vitamins B_1, B_2 and B_3, D, E and K, phytins, phytosterons, etc. in the oil. Oil cakes, the meat of the fruit and harvesting remnants suitable for producing silage, are used as animal feed (Nikolić et al., 2014). Seeds of other Cucurbita species can also be used to obtain oil, but the best quality oil is obtained by pressing the fruit of the oil-rich variety.

Linseed (*Linum usitatissimum* L.) is an annual plant belonging to the *Linaceae* family, and originates from the selection of the wild species *Linum angustifolium* Huds. over 9,000 years ago in the region of the Fertile Crescent (Kvavadze et al., 2009). Linseed production spread quickly in Africa, Asia and Europe. Fiber obtained from the stem was used to produce textiles, and the seed as food. The long history of cultivation led to the differentiation of several linseed varieties. The most important are linseed and flax used to produce fiber. Linseed is planted in the spring, while the fiber variety is planted in the spring in continental regions, and in regions where winter air temperatures are not below -10°C it can also be planted in the autumn. The vegetation period of spring varieties is 100-115 days, and of winter varieties 240-250 days. Plants develop a spindle shaped shallow root system, predominantly in the plowed soil layer. The stem of oil varieties is upright and branching, 50-70 cm tall, covered with a wax layer. Small elongated leaves with short stalks develop on it. As plants mature, leaves change color and fall off.

Bisexual flowers, most frequently with blue petals, develop on tips of branches in racemose flower heads. The plant is predominantly self-pollinating. The fruit is a ball shaped capsule that does not burst when ripe, containing several seeds. The seed is flat with a shiny brown or yellow envelope. Studies of the seed have shown that it has high nutritive and energy value. Oil has the highest content (38-47%) with a high share of omega-3 fatty acids, followed by sugar (22-35%), total protein (18-24%), mineral salts (2. 3-3. 5%) and other compounds (Filipović et al., 2014). The oil has multiple uses. If extracted by cold pressing, it is used in the food industry for food preparation. Due to its high content of alpha-linolenic acid the oil is very important for preparing functional foods. Technical oil is used to manufacture paints for painting and printing, varnishes and agents for impregnation of furniture and wooden joinery, for manufacturing cosmetics, in the pharmaceutical industry, to obtain biofuels (Gilbery et al., 2009) and for other purposes. Flax boon is used in construction to produce composite materials (Khazma et al., 2008). In nutrition, unbroken or the milled seed is used as a raw material in bakery and patisserie industries. Linseed is also added to mixtures for caged birds. Oil cakes are very nutritious and very easily digested, and are used as concentrated animal feed for swine and cattle (Gilbery et al., 2010).

Environmental conditions

A comparison between these oil plants and environmental and soil conditions and our agroecological conditions (Table 1) shows:

Water regime. Alternative oil plants have moderate water requirements. They economize available water, as shown by the transpiration coefficient, which is under 400 in most species (Đurić et al., 2015). These plants have xenomorphic structure and root systems with good suction power, and can therefore tolerate short droughts. Dynamics of water uptake and utilization show that plant requirements are highest in phases of flowering and fruit formation. In our agricultural regions, this is the beginning of the summer period (second half of May and June) when average volumes of precipitation are highest. In general, the average water regime in our agricultural areas is favorable for growing these oil plants even without irrigation (Maletić, Jevđović, 2006; Glamočlija et al., 2015).

Thermal regime. Mentioned species are plants of tropical and subtropical regions and for optimal growth and development, they incorporate much heat, mostly in generative phenophases. In addition to their pronounced thermophilic character,

species such as linseed, poppy, false flax and safflower tolerate frost in initial phases of growth. By comparing these plants and the annual heat distribution in our agricultural regions, it can be emphasized that the thermal regime in flatland and hilly areas is favorable for growing alternative oil plants (Glamočlija, 2004; Sampath, 2009; Đurić et al., 2015).

Soil conditions. The relationship with the soil depends on the development of the root system of each plant species. Even though best results (yields and quality of the main product) will be achieved on fertile and structured soils, by using more intensive agro-technical measures these plants can be grown on soils less suitable for the main crops (Filipović et al., 2010; Popović et al., 2017). Numerous types of soils in our agricultural areas offer the possibility for optimal creation of regions for growing these species.

Table 1. *Multiannual yearly average rainfall and heat distribution*

Region, month	Vojvodina, Pančevo		Central Serbia, Paraćin	
	Precipitation	Temperatures	Precipitation	Temperatures
1.	55	1.6	43	0.1
2.	51	2.1	37	4.6
3.	54	6.9	80	8.2
4.	52	13.0	61	13.8
5.	80	18.3	110	17.7
6.	82	22.4	50	23.9
7.	55	24.0	62	23.9
8.	56	23.5	71	23.6
9.	54	18.5	70	18.1
10.	54	11.2	67	12.2
11.	52	7.1	54	7.8
12.	45	2.4	52	1.9
Sum, average	682	12.6	757	11.9

Source: * *Data: Republic Hydrometeorological Service of Serbia*

Technology of production

Adequate selection of sites and crop rotation enable significant savings for agro-technics reflected in reduction of land cultivation, additional fertilization and plant protection.

The system of basic and pre-planting cultivation should be determined based on the preceding crop, the grown species and the general state of the soil. Reduced and conservational basic cultivation offers an advantage on less weed-infested soils and after a preceding crop for which intensive agro-technics were applied.

Alternative oil plants are crops with different planting times. They should be planted using precise seeding machines and using seeds with declarations, while the time and manner of planting are determined based on climate and soil conditions.

Measures for plants with broadly spaced rows should include mechanical weed suppression with one or two cultivations and hoeing between the rows. Irrigation is used in extremely dry periods. Water quantity should be determined according to soil moisture content and plant needs.

Plant protection against weeds is orientated toward indirect (preventive) measures, such as crop rotation, land cultivation, optimal crop density, and mechanical methods. For protection of plants against pests, crop rotation with broad plant replacement, monitoring the life cycle of insects, and local suppression when they appear in certain plant sections, are used. Against pathogens, efficient measures of protection are crop rotation after crops they have no common pathogens, selection of more tolerant varieties, planting healthy disinfected seeds, removing diseased plants, and only in case of a more severe attack, preventive chemical protection.

The harvest should be adapted to plant maturation. On small areas, harvesting is combined, manual and by machines, and on large areas it is in one phase using combine harvesters for wheat. Having in mind that seeds of most species are very small, machines must be adjusted before the harvest and work quality should be checked occasionally.

Storage of the main product, seeds, is an important agro-technical measure. These fruits have high oil content so inadequate storage conditions can cause a process of degradation of these compounds.

Economics of cultivation

Before opting to produce any of the mentioned alternative oil plants, the farmer should prepare a cost estimate of production and assess profit after the sale of produced goods.

By growing safflower on one hectare, using standard agro-technics following results can be achieved (Table 2).

Table 2. *Analytical calculation for safflower production*

Elements	Quantity	Price	Value, rsd
Yield	1.800 kg ha^{-1}		
A) **Value of production**		60 rsd	**108.000**
B) **Costs of production**			
Cost of materials			
- NPK mineral fertilizer	350 kg ha^{-1}	42 rsd	14,700
- seed	10 kg ha^{-1}	80 rsd	800
Machines			
- plowing	8,500 rsd		8,500
- preplanting preparation	2,000 rsd		2,000
- planting	2,200 rsd		2,200
- inter-row cultivation	2,500 rsd		2,500
- combine harvester	10,000 rsd		10,000
- seed transport	2,000 rsd		2,000
- preparation for storage	2,000 rsd		2,000
Total expenses			**44,700**
Gross financial result			**63,300**

*** Source:** *Đurić, Spasić*

Prices for seed and seed goods were obtained from the world stock market. For the production of safflower seed, gross profit would be 63,300 dinars, not taking into account the value of by-products.

In the production of false flax for seed under our very favorable agro-ecological conditions, a yield of 1,100 kg ha^{-1} can be realistically expected. With this yield, a gross profit of 54,000 dinars can be realized (Table 3).

Table 3. *Analytical calculation for false flax production*

Elements	**Quantity**	**Price**	**Value, rsd**
Yield	1,100 kg ha^{-1}		
A) **Value of production**		85 rsd	**93,500**
B) **Costs of production**			
Cost of materials			
- NPK mineral fertilizer	300 kg ha^{-1}	40 rsd	12,000
- seed	8 kg ha^{-1}	100 rsd	800

Elements	Quantity	Price	Value, rsd
Machines			
- plowing	8,500 rsd		8,500
- preplanting preparation	2,000 rsd		2,000
- planting	2,200 rsd		2,200
- inter-row cultivation			
- combine harvester	10,000 rsd		10,000
- seed transport	2,000 rsd		2,000 rsd
- preparation for storage	2,000 rsd		2,000 rsd
Total expenses			**39,500**
Gross financial result			**54,000**

*** Source:** *Đurić, Spasić*

Taking into account the fact that in the mid-20th century in Serbia castor bean was very successfully grown in Banat and Pomoravlje on 7,000 hectares, it would be easy to re-introduce this plant into production, because the seed has a high price on the market. With an average seed yield of 2,000 kg ha^{-1} the producer would achieve a gross profit of 78,500 dinars (Table 4).

Table 4. *Analytical calculation for castor bean production*

Elements	Quantity	Price	Value, rsd
Yield	2,000 kg ha^{-1}		
A) **Value of production**		64 rsd	**128,000**
B) **Costs of production**			
Cost of materials			
- NPK16:27:7	200 kg ha^{-1}	70 rsd	14,000
- KAN 27%	150 kg ha^{-1}	32 rsd	4,800
- seed	15 kg ha^{-1}	100 rsd	1,500
Machines			
- plowing	8,500 rsd		8,500
- preplanting preparation	2,000 rsd		2,000
- planting	2,200 rsd		2,200
- inter-row cultivation	2,500 rsd		2,500
- combine harvester	10,000 rsd		10,000
- seed transport	2,000 rsd		2,000
- preparation for storage	2,000 rsd		2,000
Total expenses			**49,500**
Gross financial result			**78,500**

*** Source**: *Đurić, Spasić*

Table 5. *Analytical calculation for oil poppy production*

Elements	Quantity	Price	Value, rsd
Yield	900 kg ha^{-1}		
A) **Value of production**		300 rsd	**270,000**
B) **Costs of production**			
Cost of materials			
- NPK15:15:15	400 kg ha^{-1}	42 rsd	16,800
- KAN 27%	100 kg ha^{-1}	32 rsd	3,200
- seed	10 kg ha^{-1}	455 rsd	4,550
- insecticide Nurelle	2 l ha^{-1}	1,500 rsd	3,000
Machines			
- plowing	8,500 rsd		8,500
- preplanting preparation	2,000 rsd		2,000
- planting	2,200 rsd		2,200
- inter-row cultivation	2,500 rsd		2,500
- protection against insects	4,000 rsd		4,000
- combine harvester	10,000 rsd		10,000
- seed transport	2,000 rsd		2,000
- preparation for storage	2,000 rsd		2,000
Total expenses			**60,750**
Gross financial result			**209,250**

*** Source**: *Đurić, Spasić*

Oil poppy is grown for its seed, and as indicated by our production calculation, with the new varieties producers achieve excellent yield and financial results (Németh et al., 2001; Popović et al., 2018a), (Table 5).

The best gross financial result achieved by growing oil poppy is 209.250 dinars, which is an important incentive to grow this oil plant.

Under our agroecological conditions, Cucurbita has high yields of total biomass, so in addition to the seed, high quality fodder, consisting of the fruit after seed extraction and leaf cuttings, is also obtained. According to data provided by Glamočlija (2004) and Berenji (2010), in the regions of Srem and Bačka, the average yield of dry seed is about 600 kg ha^{-1}, although in years with higher precipitation or if crops are irrigated, yields were significantly higher. With an average yield and sale of unprocessed seeds, a high gross financial result is achieved (Table 6).

Table 6. *Analytical calculation for cucurbita production*

Elements	Quantity	Price	Value, rsd
Yield	600 kg ha^{-1}		
A) **Value of production**		450 rsd	**270,000**
B) **Costs of production**			
Cost of materials			
- NPK16:16:16	400 kg ha^{-1}	42 rsd	16,800
- KAN 27%	150 kg ha^{-1}	32 rsd	4,800
- seed	10,000 seeds	1. 5 rsd	15,000
Machines			
- plowing	8,500 rsd		8,500
- preplanting preparation	2,000 rsd		2,000
- planting	2,200 rsd		2,200
- inter-row cultivation	2,500 rsd		2,500
- machine harvesting	10,000 rsd		10,000
- seed transport	2,000 rsd		2,000
- seed washing and drying	12,000 rsd		12,000
- seed storage	2,000 rsd		2,000
Total expenses			**77,800**
Gross financial result			**192,200**

*** Source:** *Đurić, Spasić*

For farmers, linseed is becoming an increasingly interesting oil plant due to the growing demand and use of its seeds directly in human nutrition, but also for processing to obtain oil. With an average yield of 1,300 kg per ha^{-1} and a wholesale price of 120 dinars per kilogram, one hectare can yield a gross profit of 106,600 dinars (Table 7).

Table 7. *Analytical calculation for linseed production*

Elements	Quantity	Price	Value, rsd
Yield	1,300 kg ha^{-1}		
A) **Value of production**		120 rsd	**156,000**
B) **Costs of production**			
Cost of materials			
- NPK mineral fertilizer	350 kg ha^{-1}	42 rsd	14,700
- seed	40 kg ha^{-1}	200 rsd	8,000
Machines			
- plowing	8,500 rsd		8,500
- preplanting preparation	2,000 rsd		2,000
- planting	2,200 rsd		2,200

Elements	Quantity	Price	Value, rsd
- combine harvester	10,000 rsd		10,000
- seed transport	2,000 rsd		2,000
- preparation for storage	2,000 rsd		2,000
Total expenses			**49,400**
Gross financial result			**106,600**

*** Source**: *Đurić, Spasić*

Conclusions

Numerous research results to date on the issue of optimal methods of growing alternative oil plants under our agro-ecological conditions permit following conclusions:

- the six described plant species (safflower, false flax, castor bean, oil poppy, cucurbita and linseed) belong to different botanical families, but have a common characteristic that they contain over 40% of oil in their fruits or seeds that can be extracted by standard extraction methods and used in various industries, and also in households for food preparation;

- based on biological properties of these plants, foundations for production technology in agricultural areas have been designed, and all operations related to the growing of these plants can be done using standard agricultural machinery, with certain adjustments to the work of the machines;

- by comparing the relationship between these plants and climate and soil conditions, it is evident that with the exception of false flax, the other five species originate from tropical and subtropical areas, and therefore have high heat requirements for growth and development during the vegetation period;

- also, researched plant species very rationally use the water they uptake, have xenomorphic structure and tolerate occasional droughts;
- analysis of climate conditions in our agricultural areas, in flatlands and hilly regions, up to 500 m altitude, shows that genotypes with shorter vegetation periods can be successfully grown in the most important agricultural areas of Serbia;

- prepared cost calculations, compared with the achieved yield and the price of obtained seed, establish a gross financial result with a value that is positive and higher than for most main crops grown on large agricultural areas;

- the lowest gross financial result is realized by growing false flax (54,000 dinars); followed by safflower (63,300 dinars), and castor bean (78,500 dinars);

- when growing the following three species this value is significantly higher exceeding the value of 100,000 dinars: linseed (106,600), cucurbita (192,200), with the highest gross profit realized by growing oil poppy (209,250 dinars);

- these significant differences for the second three species compared to first three result from the fact that they are widely used in the food industry and in the production of various household food supplements;

- financial effects would be even better if the calculation would also take into account the value of by-products, harvest residues and remnants after preparing and processing seeds in the industry;

- From the organizational, economic and agro-technical point of view, there is much justification for our small farmers to designate sections of their land for growing one or several of these plant species, to equip themselves with seed processing machines and to appear on the market as sellers of final products. A great chance also exists in organizing organic production of alternative oil plants.

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AGRICULTURAL AND ECONOMIC HIGHER EDUCATION - VECTOR OF LEADERSHIP WITHIN YOUTH[1]

Nicolae Istudor[2], Emilia Gogu[3], Irina Elena Petrescu[4]

Abstract

This paper investigates the correlation between the number of students from agricultural field and the number of farms in agriculture from Romania. According to the nomenclature of the university specializations, the educational system of the agricultural field is presented in the "Vegetable and animal resources engineering branch". According to the Government decisions number 140/2017 and 615/ 2017, in the university year 2017 – 2018, in Romania were 22 universities (state and private) that offered a 165 bachelors programs, with a total number 12.420 places.

The biggest number of places is offered by the University of Agronomic Sciences and Veterinary Medicine of Bucharest, with a total number of 2640 places, representing 21% from the total offer. It is noticed that most students who have opted for an agricultural study program have as residence the countryside and it is feasible to assume that they will reintegrate to another level in agricultural activity. This was the argument that justified us to determine the correlation between the number of student enrolled in the agricultural field and the number of farms in agriculture.

From a dynamic point of view, there is a decrease in the number of students as well as the oscillation of the number of agricultural farms but also decreasing. The process of decreasing the number of agricultural farms is mainly supported by the sale.

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2 Nicolae Istudor, Ph.D., Full Professor, Bucharest University of Economic Studies, Department of Agro-food and Environmental Economics, Piata Romana no. 6, Bucharest, Romania, E-mail: nicolae.istudor@ase.ro

3 Emilia Gogu, Ph.D., Associate Professor, Bucharest University of Economic Studies, Department of Statistic and Econometrics, Piata Romana no. 6, Bucharest, Romania, E-mail: emilia.gogu@csie.ase.ro

4 Irina Elena Petrescu, Ph.D., Associate Professor, Bucharest University of Economic Studies, Department of Agro-food and Environmental Economics, Piata Romana no. 6, Bucharest, Romania, E-mail: irina.petrescu@eam.ase.ro

The analysis of the data shows that on an increase with a student in the agricultural field it mitigates the decrease of the number of agricultural farms on average by 12. As well, in the paper it is presented a comparison between Romania and Poland regarding the number of agricultural farms and age of the farmers.

Key words: *agriculture, education, leadership*

Introduction

Nowadays, in Romania, the agricultural sector has a special role in the development of leadership, a "launching" in entrepreneurship of graduates of higher education. Business facilities in the agricultural sector, respectively comparative advantages of graduates who would like to start business in rural areas, especially from agriculture or agro-tourism, are the following:

- Formation of independent organizations/independent individuals.
- Development of small and medium enterprises.
- Absorption of European and national funds.
- Attracting students from rural areas - to which we find a series of competences in the field obtained by tradition in the family.
- Strategic - a graduate from agriculture is less inclined to leave the country.
- The sphere of economic sustainability.
- Support provided by EU bodies for rural development.
- Supported Future - Global demographic growth creates a pressure on the volume of agricultural production.

Analysis of agricultural higher education and agricultural sector

The offer of studies by universities and by license areas in Romania

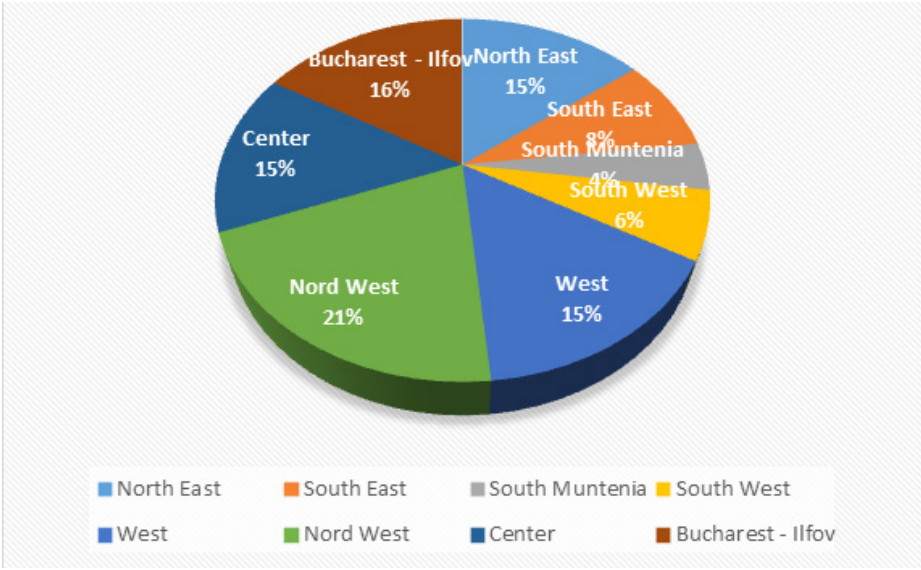
According to the nomenclature of the university specializations, the educational system of the agricultural field is presented in the "Vegetable and animal resources engineering branch". According to the Government decisions number 140/2017 and 615/ 2017, in the university year 2017 – 2018, in Romania are 22 universities (state and private) that offer a 165 bachelors programs, with a total number 12.420 places. The biggest number of places is offered by the University of Agronomic Sciences and Veterinary Medicine of Bucharest, with a total number of 2.640 places, representing 21% from the total offer.

Table 1. *Number of Bachelor's Degree Programs and Tuition Number in the Branch Plant and Animal Resources Engineering by Bachelor's Field in the academic year 2017-2018*

Element	No. of programs	Tuition number
State universities	**146**	**11.130**
Agronomy	27	1.910
Biotechnology	10	455
Horticulture	18	1,305
Food Engineering	41	2,905
Forest Engineering	5	295
Engineering and Management in Agriculture and Rural Development	19	2.280
Engineering and Management in Agriculture and Rural Development	1	50
Silviculture	13	1,065
Zootechnics	12	865
Private universities	**19**	**1.290**
Agronomy	1	30
Biotechnology	1	25
Horticulture	2	90
Food Engineering	8	630
Engineering and Management in Agriculture and Rural Development	6	455
Silviculture	1	60
Total	**165**	**12.420**

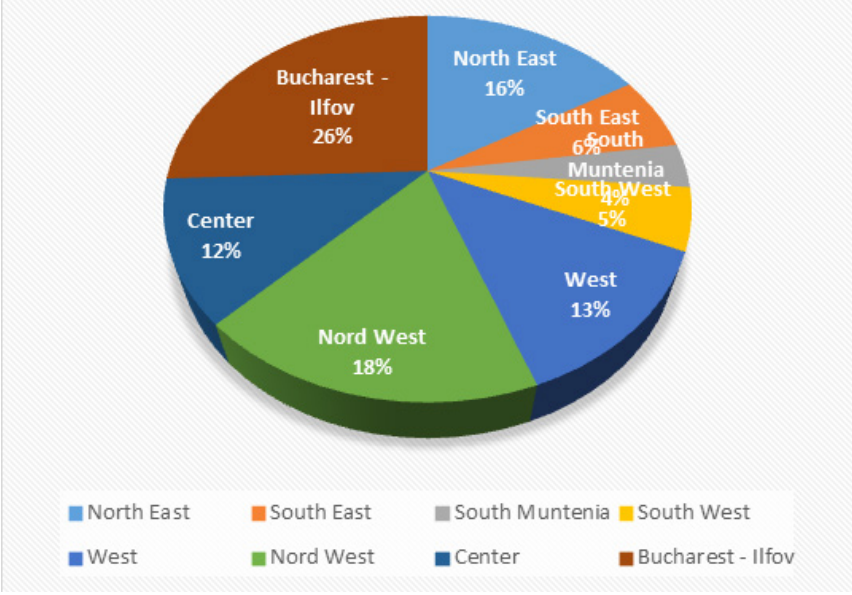
Source: *Processing by GD no.140 / 2017 and GD no. 615/2017*

Graph 1. *Number of Bachelor's Degree Programs in the Branch Plant and Animal Resources Engineering by regions in the academic year 2017-2018*



Source: *Processing by GD no.140 / 2017 and GD no. 615/2017*

Graph 2. *Number of Tuition Number in the Branch Plant and Animal Resources Engineering by regions in the academic year 2017-2018*



Source: *Processing by GD no.140 / 2017 and GD no. 615/2017*

Analysis of agricultural entrepreneurship - agricultural farms

The paper presents the results of a dynamic and correlation analysis on the number of students enrolled in the agricultural field and the number of agricultural farms. The increased number of agricultural farms is and has been generated by the return of land after 1990 in parallel with the urban-rural remigration caused by the closure of industrial enterprises and the return of former workers to the country. The positive side of this migration phenomenon was the "shock absorber" for the shock of unemployment.

Table 2. *Level, dynamics and structure of agricultural farms by development regions in 2005-2016*

Region	2005	2007	2010	2013	2016	Dynamics 2016/2005 %	Share in region 2016
Romania	4.256.150	3.931.350	3.859.040	3.629.660	3.422.030	80,40	100%
North West	591.510	533.770	528.460	499.860	478.490	80,89	14,0
Center	440.710	398.540	394.650	358.470	330.950	75,09	9,7
North East	854.870	807.460	790.790	754.530	720.240	84,25	21,0
South East	532.150	501.420	460.330	433.040	410.220	77,09	12,0
South Muntenia	847.560	762.890	800.830	753.590	694.660	81,96	20,3
Bucharest Ilfov	63.860	62.410	33.490	25.320	21.020	32,92	0,6
South West	608.160	580.610	576.600	557.850	539.550	88,72	15,8
West	317.330	284.260	273.890	247.000	226.900	71,50	6,6

Source: *Calculations by EUROSTAT, http://ec.europa.eu/eurostat/data/database Agriculture chapter accessed May 2018*

Not all agricultural farms produce for the market and are creating paid jobs, a large part of which are non-farm surviving farms, proof being the discrepancy between the number of agricultural farms and the volume of employed labour (3.422.030 farms compared to 1.587.650 people employed).

Table 3. *Labour force employed on agricultural farms by development regions in 2005-2016*

Region	2005	2007	2010	2013	2016	2016/ 2005 %	% 2016
Romania	2.595.590	2.205.280	1.610.260	1.552.630	1.587.650	61,17	100,0
Nord West	344.170	282.200	237.640	216.420	217.250	63,12	13,7
Center	265.880	216.080	173.470	156.160	156.270	58,77	9,8
North East	523.920	462.260	354.720	325.690	346.530	66,14	21,8
South East	336.880	307.740	201.100	194.360	203.760	60,48	12,8
South Muntenia	538.070	397.100	285.850	279.380	276.200	51,33	17,4
Bucharest Ilfov	45.670	46.040	14.720	12.150	12.750	27,92	0,8
South West	373.080	347.520	227.000	251.630	271.940	72,89	17,1
West	167.930	146.340	115.770	116.840	102.950	61,31	6,5

Source: *Calculations by EUROSTAT, http://ec.europa.eu/eurostat/data/database Agriculture chapter accessed May 2018*

A big share of Romanian labour force is enrolled in agricultural activities. As we can see, starting from 2005 the total number of people working in agriculture has decrease, as in 2016, more than 1,5 million people are having as main activity.

The biggest share from the total number is in the regions having big surfaces of agricultural land, such as: North-East, Sud-Muntenia and South-West. The region Bucharest-Ilfov has the smallest share because it is more focused on industry and services.

Table 4. *Labour productivity of agricultural farms at the price of inputs*[5] *(euro/pers.)*

GEO/TIME	2005	2007	2010	2013	2015	Dynamics 2015/2005%
Romania	4.952	6.485	9.502	11.436	9.741	196,7
Nord-West	5.468	8.114	8.349	9.825	8.876	162,3
Center	5.863	9.426	10.554	12.847	11.479	195,8
Nord-East	4.434	5.350	7.231	9.052	7.332	165,4
South-East	5.722	6.357	12.061	15.305	13.192	230,5

5 Labor productivity determined as a ratio between the financial result of the agricultural industry and the labor force employed on agricultural farms.

GEO/TIME	2005	2007	2010	2013	2015	Dynamics 2015/2005%
South - Muntenia	4.101	5.812	9.614	12.536	10.869	265,1
Bucharest - Ilfov	4.608	3.922	11.496	19.724	14.817	321,5
South-West Oltenia	3.783	4.053	7.522	7.850	6.418	169,7
West	7.940	11.266	16.163	16.977	15.330	193,1

Source: *calculation from EUROSTAT data, http://ec.europa.eu/eurostat/data/database Agriculture chapter, accessed may 2018*

Even if the total number of labour force has decrease in the period 2005 – 2016, the labour productivity in agricultural activities has increased in all the regions. At national level we can see an increase of more than 96%, but Bucharest-Ilfov is the leader, with an increase of more than 220%. This region has the smallest agricultural land, but is the most develop and a lot of investments were made, especially in machinery.

Table 5. *Number of agricultural farms managed by persons under 25 years, by region, in the period 2005-2016*

Region	2005	2007	2010	2013	2016	2016/ 2005 %	% 2016
Romania	11.130	10.480	33.290	21.860	14.020	126,0	100,0
North-West	2.300	1.910	4.700	3.140	1.740	75,7	12,4
Center	970	1.090	3.110	1.860	1.250	128,9	8,9
North-East	2.940	1.570	7.700	3.810	2.270	77,2	16,2
South-East	1.020	620	4.130	3.860	2.540	249,0	18,1
South-Muntenia	1.520	1.630	6.380	4.430	2.850	187,5	20,3
Bucharest-Ilfov	110	20	190	120	120	109,1	0,9
South-West Oltenia	1.290	2.020	4.700	2.800	2.030	157,4	14,5
West	970	1.630	2.390	1.850	1.230	126,8	8,8

Source: *Calculations by EUROSTAT, http://ec.europa.eu/eurostat/data/database Agriculture chapter accessed May 2018*

The European Fund for Agriculture and Rural Development is financing young farmers, representing persons under 40 years. In Romania, the rural

area is facing the problem of depopulation and aging. In order to maintain the young people in the rural area, the European Union has created special measures for encouraging of developing business.

In Romania, the total number of farms managed by persons under 25 years had an oscillating evolution. In 2016 it has increased with 26% in comparison with 2005, but still, in 2010 we had a total number of 33.290.

Table 6. *Number of agricultural farms administered by managers 25-34 years by development regions 2005-2016*

Region	2005	2007	2010	2013	2016	2016/ 2005 %	% 2016
Romania	215.100	160.950	247.150	150.100	97.650	45,40	100,0
North-West	30.160	24.400	35.700	22.860	16.580	54,97	17,0
Center	22.050	15.250	26.070	14.870	8.900	40,36	9,1
North-East	59.590	43.780	60.070	35.460	22.090	37,07	22,6
South-East	25.750	21.000	28.960	16.430	9.900	38,45	10,1
South Muntenia	36.780	24.000	47.060	29.220	17.930	48,75	18,4
Bucharest-Ilfov	1.930	1.370	1.890	680	490	25,39	0,5
South-West Oltenia	26.490	19.930	31.390	20.920	14.780	55,79	15,1
West	12.350	11.240	16.020	9.670	6.990	56,60	7,2

Source: *Calculations by EUROSTAT, http://ec.europa.eu/eurostat/data/database Agriculture chapter accessed May 2018*

The number of agricultural farms managed by young farmers with age between 24-24 years has decreased significantly, with 55% in 2016 in comparison with 2005, in all the regions, but especially in Bucharest-Ilfov because in this region, the young people are more interested in other activities, especially services.

Correlation of the number of registered agricultural students and the number of farms in agriculture

From the profile point of view, most students who have opted for an agricultural study program come from the countryside, and it is feasible to assume that they will reintegrate to another level in agricultural activity. This argument justifies us to determine the correlation between the number of students enrolled in the agricultural field and the number of farms in agriculture, made by a gap of 5 years (e.g.

no. of students in 2.000 correlated with Number of agricultural farms in 2005) to surprise an average of 3 years since graduation. In order to capture more accurately the impact of the students and the graduates in the field, the agricultural farms managed by young farmers were selected as follows:

a. Farms with managers under the age of 25
b. Farms with managers aged 25-34 years

Table 7. *Number of agricultural farms administered by managers aged 25-34 years by development regions in 2005-2016*

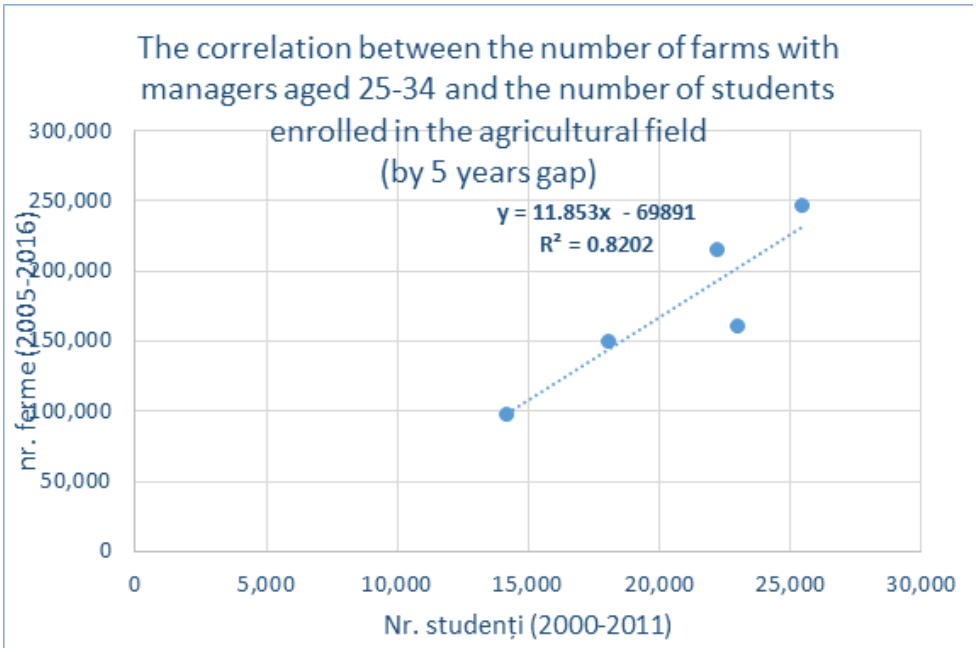
No. of students enrolled in agriculture		No. of farms with farmers under 25 years old		No. of farms with farmers 25-34 years old	No. of farms with farmers under 34 years old
2000	22.242	**2005**	11.130	215.100	226.230
2002	22.982	**2007**	10.480	160.950	171.430
2005	25.468	**2010**	33.290	247.150	280.440
2008	18.076	**2013**	21.860	150.100	171.960
2011	14.195	**2016**	14.020	97.650	111.670

Source: *Calculations by EUROSTAT, http://ec.europa.eu/eurostat/data/database Agriculture chapter accessed May 2018*

a) The first test of the correlation between the number of farmers under 25 years and number of students enrolled in the agricultural field does not confirm the hypothesis that students during the years of study would administer an agricultural farm. The regression function is not valid and the regression coefficient is not significant.

b) The second correlation between the number of farmers aged 25-34 and the number of students enrolled in the agricultural field confirms the hypothesis that a graduate of agricultural studies has a direct, strong impact on the administration of agricultural farms.

Graph 3. *Correlation between the number of farms, young managers and students enrolled in the field of agriculture*



Source: *According to authors calculation*

From a dynamic point of view, there is a decrease in the number of students as well as the oscillation of the number of agricultural farms but also decreasing. The process of decreasing the number of agricultural farms is mainly supported by the sale. From graphical representation and regression output, there is a direct and strong link between the two variables. The analysis of the data shows that on an increase with a student in the agricultural field it mitigates the decrease of the number of agricultural farms on average by 12. We can state, with a probability of 95%, that true value of the regression coefficient β_1 would be covered by the confidence interval $1{,}66<\beta_1<22{,}05$ (the minimum decrease of the decrease is 1.66 and the maximum is 22).

Table 8. *Correlation results*

Summary output					
Regression Statistics					
Multiple R	0,9056				
R Square	0,8202				
Adjusted R Square	0,7603				
Standard Error	28561,2				
Observations	5				
ANOVA					
	df	*SS*	*MS*	*F*	*Signif. F*
Regression	1	11163560537	11163560537	13,685	0,03429
Residual	3	2447226463	815742154,2		
Total	4	13610787000			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-69890,59	67204,38	-1,04	0,37	-283764,93	143983,75
Number students	11,85	3,20	3,70	0,03	1,66	22,05

Source: *According to authors calculation*

The ANOVA output shows that the intensity of the link between the two variables is very high, so 82% of the variation in the number of farms can be explained by the variation in the number of graduates in the agricultural field, the remaining 18% is the influence of other unregistered factors. The overall regression model evaluation, based on the correlation ratio and the Fisher F test (where Signif. F is less than 0.05%), shows that the regression model is correctly specified with a probability of 95%.[6]

It is equally interesting to analyse the share of young farmers in the direct management of agricultural farms. Previously, the intensity of the link between graduates and the number of agricultural farms has been demonstrated, confirming their place and importance in the development of the sector, but they are not necessarily

6 It is worth noting that the value of the indicators is not sufficiently reliable due to the reduced length of the data series because of the lack of information, but this correlation is a valid regression model.

found in the category of direct managers. The share of young farmers under the age of 34 in 2016 was only 1.6%, compared to Poland this share is over 10%.

Often, in Romania, farm manager is considered head of the family (the older person on the farm or owns the land) and the young graduates usually fall into the category of unpaid family worker[7]. This fact results very easily from the very high share of agricultural farms administered by persons over 65 years old, which in the year 2016 was 46%, persons who do not necessarily have a solid / university training in the field either agricultural or economic. From this point of view, agricultural farms do not develop in the pace of innovative technologies. Families that develop farms are typically more traditional, even rudimentary, either financially or often lacking vision/strategy.

Table 9. *Number of agricultural farms administered by managers by age group in Romania and Poland during 2005-2016*

Year/element	**2005**	**2007**	**2010**	**2013**	**2016**	**Share 2016 %**
ROMANIA						
TOTAL from which:	4.256.150	3.931.350	3.859.040	3.629.660	3.422.030	100,00
under 25 years	11.130	10.480	33.290	21.860	14.020	*0,4*
25-34 years	113.290	77.750	86.800	53.510	40.720	*1,2*
35-44 years	-	467.060	609.610	504.810	398.200	*11,6*
45-54 years	756.300	666.810	636.370	614.550	630.550	*18,4*
55- 64 years	946.830	886.550	868.910	851.230	763.880	*22,3*
over 65 years		1.822.700	1.624.060	1.583.700	1.574.660	*46,0*
POLAND						**Share 2016 %**
TOTAL from which:	2.476.470	2.390.960	1.506.620	1.429.010	1.410.700	*100,0*
under 25 years	32.660	27.790	18.580	14.130	10.570	*0,7*

7 Def. macro statistics - Unpaid family worker - is the person who runs his or her activity in a family economic unit run by a family member or a relative for whom he / she does not receive remuneration in the form of salary or payment in kind. The peasant (agricultural) household is considered such a unit. If several people in a household work in their own household, one of them - generally the head of the household - is considered a self-employed worker and the other unpaid family workers.

25-34 years	276.910	263.850	203.000	159.430	133.890	*9,5*
35-44 years	-	516.690	369.560	339.130	324.870	*23,0*
45-54 years	769.550	743.860	486.300	431.810	399.150	*28,3*
55- 64 years	429.040	460.280	302.790	346.850	377.280	*26,7*
over 65 years		378490	126390	137660	164940	*11,7*

Source*: Calculations by EUROSTAT, http://ec.europa.eu/eurostat/data/database Agriculture chapter accessed May 2018*

We also wanted to compare a country that, like us, has gone through the collectivization policy, and then the de-collectivization of agriculture. In our country there are 2 million agricultural farms more than in Poland, but only 11.7% of them are managed by people under 65 years of age.

Alecu (2011) mentions that the agricultural public schools in Poland are managed by the local units and The Ministry of Agriculture and Rural Development. Also, he mentions that the ministry is managing a total number of 45 agricultural schools, with almost 14.000 students with 1400 teachers.

Table 10. *Number of students enrolled in agriculture, forestry and economics and their share in the total university system during the period 1990-2016*

Year	Total	Agriculture and silviculture[1]	Economic sciences[2]	Share of agriculture	Share of economic science %
1990	192.810	7.869	20.003	4,08	10,4
1991	215.226	9.110	24.801	4,23	11,5
1992	235.669	10.818	35.279	4,59	15,0
1993	250.087	10.861	39.867	4,34	15,9
1994	255.162	10.663	47.712	4,18	18,7
1995	336.141	10.749	83.996	3,20	25,0
1996	354.488	12.153	87.472	3,43	24,7
1997	360.590	13.457	86.861	3,73	24,1
1998	407.720	15.861	101.896	3,89	25,0
1999	452.621	19.399	105.727	4,29	23,4
2000	533.152	22.242	132.332	4,17	24,8
2001	582.221	26.898	146.110	4,62	25,1
2002	596.297	22.982	158.185	3,85	26,5
2003	620.785	24.280	172.409	3,91	27,8

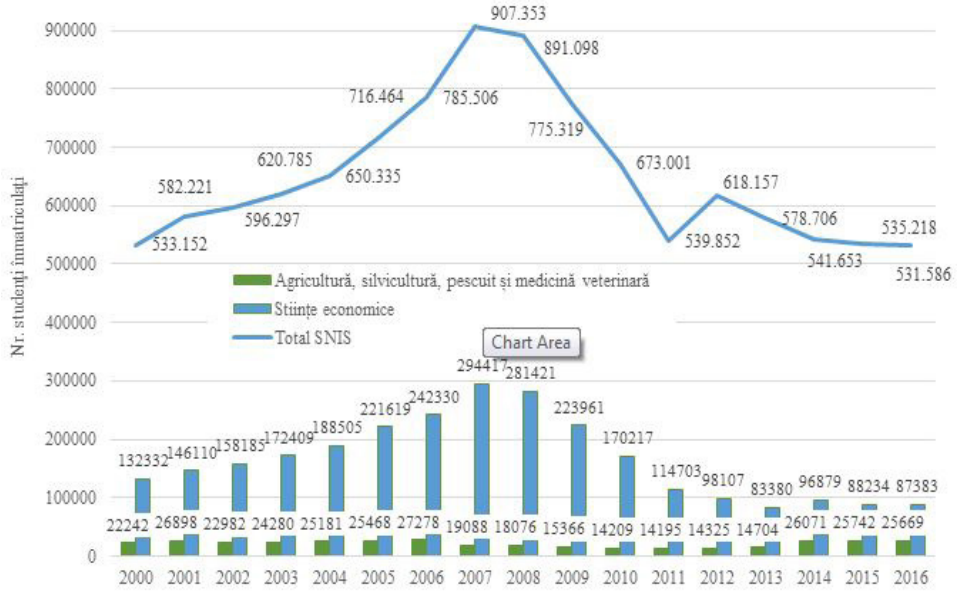
Year	Total	Agriculture and silviculture[1]	Economic sciences[2]	Share of agriculture	Share of economic science %
2004	650.335	25.181	188.505	3,87	29,0
2005	716.464	25.468	221.619	3,55	30,9
2006	785.506	27.278	242.330	3,47	30,9
2007	907.353	19.088	294.417	2,10	32,4
2008	891.098	18.076	281.421	2,03	31,6
2009	775.319	15.366	223.961	1,98	28,9
2010	673.001	14.209	170.217	2,11	25,3
2011	539.852	14.195	114.703	2,63	21,2
2012	618.157	14.325	98.107	2,32	15,9
2013	578.706	14.704	83.380	2,54	14,4
2014	541.653	26.071	96.879	4,81	17,9
2015	535.218	25.742	88.234	4,81	16,5
2016	531.586	25.669	87.383	4,83	16,4

Source: *Calculations by EUROSTAT, http://ec.europa.eu/eurostat/data/database, and tempo online INS, accessed May 2018*

The total number of students enrolled in higher education in Romania registered an oscillating evolution between 2000 and 2016. The highest number of students was recorded in 2007, with 907,353 students. Also in 2007, the highest number of students enrolled in the field of economics was registered, namely 294,417 students, representing 32.4% of the total.

According to Manole and Ion (2010), in the new approach to teaching and learning, the teachers' role has changed. They act like team member and facilitator, helping students to discover themselves their own methods of learning and encouraging them to work in groups.

Graph 4. *Dynamics of students enrolled in economic, agricultural and total SNIS in 2000-2016*



Conclusions

According to the Report on the state of higher education in Romania (Ministry of Education and Scientific Research, 2015), in 2015, out of the total number of persons enrolled in higher education, almost 86% attend study programs in state institutions and just over 14% in private education. By form of ownership, the percentages of undergraduate students differ, which is 74.4% in public education, and 85% in private education.

Regarding the evolution of the number of students enrolled in the field of agriculture and forestry, there is an oscillating evolution, reaching a minimum of 14,195 students in 2011 and the maximum of 27,278 in 2016. It is encouraging that starting with in 2014, there is a significant increase in the number of students enrolled in agriculture and forestry, reaching over 25,000 students, representing about 4.8% of all students.

The growing interest of young people in this field can be justified by massive investments made in the agricultural sector, funded through European non-reimbursable funds.

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SOME ITEMS ON MARKETING AGRICULTURAL PRODUCTS IN THE REPUBLIC OF SERBIA[1]

Nikola Ćurčić,[2] Zoran Simonović[3]

Abstract

In this paper, the necessity of identifying problems of the organization of marketing of agricultural products of the Republic of Serbia is treated. The exemption comes from the fact that marketing can be presented through a process of several steps (attention, interest, desire and action), and usually starts from a marketing process of a product, service, or organization. Most of the current marketing processes of organizations relates to the task of retaining permanent clients through activities of creating relationships between consumers, improving customer service, better representing the benefits of products and services, etc.

In the given sense, marketing of agricultural products is also considered. It is believed that modern agrarian production of Serbia is unimaginable without adequate marketing approaches that involve engaged agrarian entrepreneurs, sophisticated equipment and flexible transport networks. The agrarian entrepreneur should be incorporated into a chain that includes production, processing, turnover, banking transactions and science. Such agrarian entrepreneur must also be educated and prepared for modern agribusiness. Only in this way, and in accordance with natural conditions, already abandoned agricultural land can be used again and again, but only for the production that is in the mentioned agro-industrial chain. It is understood that the ultimate goal should be not only domestic, but above all the world market. The fact is that these processes are complex and require that marketing has a certain level of development. In addition, credit, tax, educational and other systems that influence the development of agricultural products are also important.

Key words: *marketing, agricultural product, Serbia.*

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2 Nikola Ćurčić. Ph.D., Assistant Professor, University Union – Nikola Tesla, Faculty of Management, Njegoševa Street no. 1a, 21205 Sremski Karlovci, Serbia, Phone: +381 21 21 551 85, E-mail: nikolacurcic@yahoo.com

3 Zoran Simonović, Ph.D., Scientific Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 697 28 58, E-mail: zoki@medianis.net

Introduction

Marketing can be presented through a four-step process, which begins with the research, analysis and identification of the "universe" of potential users or customers. After the first phase of the marketing process, the process of drawing attention to users that are ready for purchase, from the "universe" of the target population, follows. In the third phase, systemic influences affect potential users to become interested in and accept existing concepts or offers, which are created based on the organization's marketing activities. Finally, the success of the previous three phases should lead to the transition to potential customers into "real" customers through activities that are implemented to enable potential customers to do the desired action - buying, calling, downloading documents, subscription, membership, sales, etc.

In this regard, we deal with the analysis aimed at helping to better organize marketing in the sale and marketing of agricultural products on the market in the Republic of Serbia. The basic goals of marketing in agriculture are to explore the needs and desires of consumers, linking it to the food produced in solving and meeting its needs, as well as to ensure consumers' right to health-safe food and protecting products harmful to the life and health of consumers. The role of marketing is to initiate and raise the ecological awareness of the end consumer with the help of communication marketing instruments (event-marketing and relationship marketing). The goal of such orientation in agricultural production, involves the involvement of in participants in the process of production and transport. Here, in the first place we mean suppliers, manufacturers, distributors and exporters. This implies an active role of the state in this domain. Marketing should permanently connect ecologically conscious buyers to a business entity (Vlahović, Štrbac, 2007).

Methodology and data sources

The subject matter has a research character, and the method is also subordinate to it. Several methodological approaches were used in the research on the application of marketing in agriculture. 1) The research relied on foreign and domestic literature. This literature was important to studying the application of smart technology in agriculture today in the world. 2) Author's research in the thematic field was used. 3) At the end of the research carried out by the Institute of Agricultural Economics and associates with the previous period.

In general, the research relied primarily on foreign literature. As far as domestic sources are concerned, they are few and insufficient for a more comprehensive examination of the problem of studying some of the marketing implications of agricultural products. We believe that not only in the world but also in our country there is an interest in researching the application of marketing in the placement of agricultural products, from various modern aspects: from the aspect of sustainable development, production of healthy - environmentally sounds food, from the point of view of proper use of agrarian resources, water, natural middle in general. Foreign literature on these problems was used. That is why one of the tasks of this research was to study and present the latest insights on this issue. Internet information that is numerous and significant should also be mentioned.

Special attention is paid to periodicals (scientific journals) and to scientific consultations (chamber of works), as it is better to notice the current problems that affect the application of marketing in agricultural production.

About marketing in the production process

The presented four-step process (attention, interest, desire, action), usually refers to the beginning of a marketing process of a product, service, or organization. Most of the current marketing processes of organizations relates to the task of retaining permanent clients through activities of creating relationships to consumers, improving customer service, better representing the benefits of products and services, etc. Marketing was created to solve the problems of production and producers when the supply was higher than demand, and the ultimate goal was the realization of the produced goods and the achievement of profit for the company. Today, the essence of marketing consists in solving consumers' problems - faster and better than competition. Accordingly, it is rightly pointed out that "having a competitive advantage is the same as having a pistol in the fight over knives" (Kotler, 2003). How much marketing has changed since its inception to date is the fact that in the literature there are now two terms with the concept of marketing:[4]

1. Business marketing relates to material goods, that is, products and services designed to solve some economic problem of a person or organization.
2. Social marketing is focused on solving some non-economic problems of society related to the quality and safety of life.
3. According to the same source, in addition to the above, today they are current:
   - Environmental marketing - which aims to preserve the environment, and

4 www.link-elearning.com/lekcija-Teorija-marketinga_4208

then profit. It is developing in the recycling process.
- Intellectual marketing - includes the creation and sale of information. It does not apply to material goods, but to new values for people and society.
- Relational marketing - the central place occupies a focus on relationships of target groups, i.e. the buyer/user is indirectly introduced into the organization, through a certain value chain.

Marketing is a process whose primary importance is reflected on the establishment of a communication flow between the producer and the buyer or consumer. Marketing as an economic process takes place continuously and is an integral part of the reproduction in an enterprise. Marketing is not a promotion or an appearance of a fair or sale - it is already a process that lasts and encompasses marketing research, strategic marketing planning, and defining goals, formulating a marketing strategy, developing a marketing mix, marketing analysis, control and audit. So, it's a whole system, and every part of it is equally important and important.

Marketing Management

Marketing management is a process by which the marketing activity of a company is regulated. This is a dynamic process because the conditions both in the economy and in the company are constantly changing. Consequently, it is necessary to adapt the marketing activities as business functions of the changed conditions of the business environment and to the new business goals. In such conditions, marketing management is the process by which to initiate and direct marketing activities in order to meet the needs of citizens as consumers, businesses and companies in products and services with the achievement of profit (Milisavljević, 1999).

The previously defined marketing management activity can be analytically divided into: planning, organizing and controlling. At the planning stage, decisions are made about the goals, policies, strategies, programs and plans for marketing activities. During the organizational phase, the organizational structure is created and the immediate activity of the marketing sector is organized. Finally, at the control stage, the realization of planned decisions and the efficiency of the organization is measured and corrective actions are taken in the organization and functioning of the marketing sector of the company. The marketing management process is effective if all the management phases run continuously. Namely, certain phases of marketing management should be synchronized so as to give a

synergistic effect, to complement and stimulate each other. Thus marketing of agricultural products, as the complete logic of business-management thinking about the role of individual members of the system in the process of satisfying the needs of consumers, the growth and development of one's own resources as well as the national economy has an indispensable role in creating the increased value of products (Sudarević, 1999).

Marketing management essentially means managing the level, "timing" and the composition of demand, in a way that will help the organization achieve the goals (Kotler, Keler, 2006). The process of managing marketing activities involves analyzing market opportunities (existing or potential markets), formulating goals to be achieved on the market, defining the offer, and locating resources on selected action directions, creating an efficient organizational structure that should enable the realization of programs and plans on the market, permanent control of the achieved results of marketing activities and review of the rationality of the taken actions on the market (Milisavljević, 1999). Taking into account the aforementioned marketing management elements, it is noticeable that this process should, above all, to enable identification of market opportunities, their compliance with the company's operations and the creation of a program of actions to exploit distinctive competence in order to create a relatively lasting competitive advantage on the market (Simonović et al., 2012a).

Modern agrarian production

In the current conditions of production, agrarian production of Serbia is unthinkable without modern agrarian entrepreneurs, without modern equipment and well-organized transport networks. The agrarian entrepreneur must be in a chain that includes production, processing, traffic, banks and science. Such agrarian entrepreneur should be educated and prepared for modern agribusiness. Only in this way, and in accordance with natural conditions, already abandoned agricultural land can be used again and again, but only for the production that is in the mentioned agro-industrial chain. It is understood that the ultimate goal must be not only domestic, but above all the world market. These processes are complex and require appropriate credit, tax, educational and other support systems. The point of transition, i.e. structural changes and demographic trends, is to achieve more productive and more profitable agrarian production.

In close connection with the prominent problems of structural changes in the Serbian economy and demographic trends in agriculture, the problem of rural development in Serbia is the problem of transforming villages into modern settlements of a complete infrastructure of urban character (electricity, water, telecommunications, etc.). Spatial arrangement of rural areas and construction of road and other systems. The classical Serbian village relied exclusively on agrarian production of a natural type. Modern rural development implies the development of other non-agrarian activities if conditions for this or at least the development of processing capacities for agrarian production are at stake. It is a village as a settlement of a modern type that is not lost in space but is connected with space in all elements of today's available infrastructure.

Rural development is a part of the spatial development or spatial plan of Serbia, which implies, when it comes to agriculture, agrarian re-identification and specialization, or the use of comparative advantages for the corresponding type of production.

Factors that limit the development of agrarian regions

The limiting factors of agriculture and the agrarian sector are expressed in the form of declining demand and consumption of agrarian products on the domestic market, as well as the unfavorable relations between the realizations of the foreign trade of commodity goods trade (Simić, Stevanović, 2004). The largest decrease in production was in livestock production, while the intensity of production declines was somewhat slower in plant production.

The poor situation in the viticulture and wine sector is manifested through the reduction of grape and wine production and the loss of competitiveness of domestic wines with the increased import of wine. The movement towards fruit production had a stagnating character. Wine producers in Serbia are small do not have enough money to invest in marketing products that produce them. Investing in quality is what should be dominant, but without good marketing they cannot expect their products to be spotted on the market.

One of the main characteristics of the agro region in Serbia is their uneven development. There is a big difference in the development of the plain and mountain regions. Only 3% of the land in the mountainous region was socially owned. This means that in this region dominates the small estate divided into a dozen parcels

by farm. The natural process of concreting of the land surfaces was slow. It has started and has never been completed in an adequate way. The state should reopen and then complete this process. Production of the agrarian regions of the hilly and mountainous areas was mainly oriented towards satisfying its own needs, i.e. very little was focused on market conditions. Due to this type of circumstance, production was mostly scandalous and specialization was only in the indications. In this sense, in the hilly and mountainous areas, it was not possible to organize agricultural production on a larger scale, let alone talk about investing in some marketing. Of course, on this occasion, it should be noted that there are exceptions to which this paragraph does not apply. First of all, it is thought of as a small and medium enterprise in the agrarian sector.

There is no better situation in the equipping of hilly and mountain regions with agricultural labor. This equipment is significantly weaker than the flatland region.

About export chains of agricultural products

Considering the trends on the EU market, and bearing in mind the achieved level of production and competitiveness of domestic producers, it can be concluded that from the assumption of meeting the quality controls standards from the world market regarding the export of agrarian products, we are competitive only if we differentiate the offer, in terms of export of high quality products, with brand and / or indices of autochthonous origin.

Namely, Serbia can only build its export opportunity on the EU market using the modern concept of competitiveness, which implies creating a competitive advantage with quality and innovation, or differentiating the offer.

This strategy is partly used by Serbia in beef market, but its true dimension is this concept of strategy gained only in the products of higher level of final processing, thus exporting resources and raw materials, we are moving towards export of knowledge, technologies, innovations.

In the shortest, basic assumptions of this export strategy, or the modern concept of competitiveness, are:

- Increased investment in modernization of production,
- Harmonization of the overall legislation with WTO and EU regulations,
- Compliance with numerous standards of sanitary and veterinary control.

As the basic prerequisites for securing the modern concept of competitiveness of the domestic agrarian sector, the following can be stated:

- Increase investment in technology and innovation, or increase productivity;
- Achieving greater production, changing its structure and ensuring a stable export offer;
- Fulfilling strict quality control standards (adapting to EU standards in the field of veterinary, sanitary and photo sanitary needs, environmental protection) and harmonization of the overall legislation with the WTO and EU regulations;
- Development of marketing strategies, accentuating non-price elements of competitiveness and product branding;
- Organized performances by domestic producers and exporters; one of the ways of increasing the competitiveness of Serbia's economy and the agrarian sector is the development of business environment through clusters or "branch clusters." Clusters are groups of affiliated, export-oriented companies, with related institutions at the same location (customers, suppliers, competitors, universities, schools, marketing agencies, financial institutions, etc.).

Finally, no less important assumption of achieving competitive export of agricultural products of Serbia is also entering the WTO, which makes up about 95% of the world's total trade.

In order for WTO membership to be in the national interest, it is necessary, first of all, to increase the overall productivity of domestic agriculture and its efficiency, so that in terms of price and quality we can compete in export markets, but also in the domestic market, which to be opened by the act of lowering customs duties. This would have done most of the work in the process of EU accession, which bases most of its rules of those in the WTO. In this process, it is the most important to determine the national strategy and set priorities, in order to protect the domestic market and the most vulnerable segments of Serbia's agricultural production (Simonović et al., 2012b).

Issues related to the use of marketing in the placement of agricultural products in Serbia

In order to realize how well we know the possibilities of marketing in agricultural production of domestic producers of agricultural production, we did a survey. We asked some of our farmers for several questions. The first question concerns

the informing of agricultural producers about the possibilities of using marketing in the placement of agricultural products. As Table 1 shows, only 52,5% of the bearers claim that they know a lot about the possibilities of applying marketing in agricultural production.

Table 1. *Informing agricultural producers about the possibilities of using marketing in the placement of agricultural products*

answers of respondents	number of respondents	participation in %
quite familiar	21	52,5
medium	10	25,0
little	8	20,0
not known	1	2,5
in total n=40	40	100,0

Source: *Calculation of the author based on the survey.*

More than half of the respondents are familiar with the use of marketing in agricultural production. This is about the fact of how old this topic is and how many stakeholders in agricultural production know about it. The next question raised by the carriers was whether they would apply marketing in their agricultural production.

Table 2. *Would you apply marketing in your production?*

answers of respondents	number of respondents	participation in %
yes	33	82,5
no	2	5,0
no answer	5	12,50
in total n=40	40	100,0

Source: *Calculation of the author based on the survey.*

Interesting answers was obtained on this issue. Over 82.5% of surveyed stakeholders would use marketing to market their agricultural products, while only two respondents or 5% would not benefit. Based on this answer, it can be concluded that with domestic agricultural producers there is a great knowledge of the advantages that the application of marketing in the sale of agricultural products.

And from the respondents' answers to the next question, a high percentage structure of knowledge of this topic is observed. Only one (2.5%) of respondents did not even want to answer this question. While 82.5% see their interest in investing in marketing development.

Table 3. *Do you know that investments in marketing development create conditions for easier placement of agricultural products?*

answers of respondents	number of respondents	participation in %
yes	33	82,5
no	3	7,5
partially	3	7,5
no answer	1	2,5
in total n=40	40	100,0

Source: *Calculation of the author based on the survey.*

Better acquaintance of all those involved in agricultural production of this issue would certainly be useful and productive for our agricultural production. Serbia's agriculture has to respond too many of the challenges that wait on the road to the EU. It is precisely in this sense that the reformed Serbian agrarian policy should be organized, which would rely on the application of technical, technological and ecological standards in the agrarian sector. The same should enable the creation of modern models of agricultural producers and entrepreneurs, who would be equal to agrarian entrepreneurs in the EU.

Perhaps the solution to domestic agricultural producers represents their joint organization on the form of cooperatives or other associations with agricultural producers, all with the aim at making it easier to procure funds that are necessary for the application of smart agriculture. At present, cooperatives in Serbia are practical organizations. Most of the cooperatives in the modern way of doing business tend to think about fulfilling their current obligations. This way of thinking influences that the cooperative movement properly looks at the way to the future. The Cooperative Movement is today focused on pragmatic inclusion, responding to the given opportunities in order to adapt to the changes (Simonović et al., 2016).

Conclusion

Marketing as a concept emerged from the need to collect information about the market so that production aligned with the market requirements would get an economic sense, and the ultimate goal is always the placement of manufactured goods and making profits for the company. In this regard, product marketing is considered with the help of marketing instruments, whereby it is necessary to adequately manage to market as a process by which the marketing activity of company is regulated. This is a dynamic process, since conditions are constantly changing in the economy and in the company.

Accordingly, the research focus is given on contemporary agrarian production of Serbia. Without modern agrarian entrepreneurs and without modern equipment and well-organized transport networks, the same is unthinkable. The agrarian entrepreneur must be in a chain that includes production, processing, traffic, banks and science. Agrarian entrepreneurs are those who organize and implement agricultural production, and are the most responsible for the application of marketing in the placement of agricultural products.

Three agrarian regions of Serbia reveal diverse natural conditions for agrarian production. While in the plain region dominated by cereals, industrial plants and livestock breeding, fruit and vegetable and cattle production dominates in the hilly region, while mountain cattle breeding and fruit and vegetable production dominate. In the current conditions of the recession, the hilly and mountainous regions can appear in exports with berries (strawberries, raspberries, blackberries), where they have so far achieved significant results. Although the world has experienced a recession, it is known that the elasticity of food demands is small; demand is always present and must be covered by production. If we consider the affirmation of the agro-regional identity of Serbia in certain regions, we can conclude that, for example, the region of Sumadija can specialize in the production of plums and berries, the region of Sjenica for shady cheese, the region around Stara Planina for the production of the old mountain cheese, the region in the basin Jablanica rivers for the production of vegetables, etc.

There is a big disparity in economic development between the regions. The most developed are the plain region, and the least developed mountain, not only due to natural conditions, but above all because of socio - economic and historical circumstances. We believe that in the current moment, all regions have the chance to

use agrarian business or agrarian entrepreneurship in which marketing is used to start and organize production or redefine the already acquired comparative advantages in individual agricultural products.

Taking into account trends in the EU market, while respecting the achieved level of production and the competitiveness of domestic producers, it can be concluded that the domestic agrarian, assuming compliance with the quality controls standards of the world market in terms of export of agrarian products, can be competitive only if it differentiates the offer in terms of export of high quality products, with a brand or an indication of autochthonous origin.

The results of the research conducted with agricultural producers in the Republic of Serbia on the possibilities of using marketing in the placement of agricultural products, show that there is interest in agricultural producers in Serbia with the use of marketing opportunities. It can be concluded that agricultural producers should make more active and more use of marketing instruments when placing agricultural products. Engaging the agricultural producers in this direction would certainly contribute to the increase in potential buyers for the products they offer on the market.

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VOLATILITY OF AGRICULTURAL PRICES AS A FACTOR OF INFLATION IN THE REPUBLIC OF SERBIA

Nikola Njegovan[1], Tihomir Novaković[2]

Abstract

The stability of business in one economy has always been the primary goal that was difficult to achieve, and inflation is regularly used as the main indicator. It is a signal of a change in the general price level. The article analyzes inflation and prices of agricultural products and foodsuffs as a phenomenone, examines their causes and consequences. Also, particular importance is given to the change in prices of agricultural products and foodsuffs as well prices of inputs. Such tendencies are caused by changes that are happening on the global scale and which are gaining an increasing influence in the national bounderies. It shoves the change in the parity of prices and the impact of the global monopolistic structure on inflation. It also points out the importance of demand that causes inflation in less developed countries, and as a consequence, rising food prices, pushing further growth of wages that are not consequence of productivity growth.

Key words: *inflation, prices, agro-food products, glocal perspectives*

Introduction

Inflation[3] is a phenomenon that economists have been discussing for quite some time. However, it should be said that the first inflation was defined exclusively as monetary event that describes a situation in which "*too much quantity of money is chasing too small quantity of goods*." Today, there are mainly two approaches to inflation: a) one that is treated it as a monetary phenomenon, starting with demand, and b) one that, in defining inflation, starts from a global imbalance between supply

1 Nikola Njegovan, Ph.D., Associate Professor, University of Belgrade, Faculty of Economics, Belgrade, Kamenička Street no. 6, 11000 Belgrade, Serbia, Phone: +381 63 263 513, E-mail: nikolanj@yahoo.com

2 Tihomir Novaković, M.Sc., Assistant Professor, University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića no. 8, 21000 Novi Sad, Serbia, Phone: +381 64 61 49 526, E-mail: tihomir.novakovic@polj.uns.ac.rs

3 The term "inflation" was taken from medical literature A. Delmer (1864) indicating a sudden jump in prices and excessive issuance of non-convertible banknotes for the purpose of financing wars. Later J. M. Keyns points out that *the continuous state inflation process can seize, hidden and uncovered a large part of the wealth of its citizens* (Keynes, 1956).

and demand, hence its outcome must not necessarily be expressed in all cases as price increases.

The issue of the causes of inflation in modern era is quite complex. Some researchers thought that the causes of inflation must be sought in excessive credit and stock exchange speculation, budget deficits, cheap money policies, unsecured bank credit policy and the war needs of the states. Therefore, the increase in monetary mass leads to the emergence of inflation, so the main focus should be on credit policy, open market policy and the balance of payments situation. However, observed exclusively from the monetary side, four main causes of inflation can be identified: 1) inflation of effective cash demand - inflation of purchasing power, 2) inflation caused by disproportionate distribution of real national income, 3) inflation caused by reduction of commodity funds, and 4) Adverse developments in the balance of payments.

When it comes to the consequences that inflation produces on the real economy and the general conditions of business, they are numerous. They are reflected in the general instability of the economic environment, which in particular means distortion of relative prices in the economy, pressure on the course, lower real wages, higher interest rates on borrowing money, higher state risk and many other implications.

In the case of the Republic of Serbia, it can be said that it is in a position to permanently implement monetary measures and that way regulate the market situation, since structural measures have been missing in the scope that would be more significant for decades. Thus, inflation in the previous three decades did not generally fall below 4%, and at the end of the 20th century, the record high inflation rate was observed in the global - World scale (Avramović, 2002).

Today, inflation in Serbia has a multi-dimensional character because of the inflation of demand, inflation of costs, structural and imported inflation that primarily indicates the disorder of the economic system. Therefore, macroeconomic stabilization should imply the establishment of an internal and external balance, and as a consequence, it should have a low and stable inflation rate[4]. Hence, it

4 In sutch conditions, monetary policy in addition to the inflation rate, must also account for other factors that can cause instability. Changes in employment, economic growth, in prices of real and financial assets, level of indebtedness of entreprises and banks (leverage) and the presence of non-transparent and complex financial derivatives are just some of the possible factors that are endangering the stability of transition countries.

can be said that inflation, in today's economic circumstances, is an economic category that has been placed under control. However, it should be emphasized that in a long run monetary measures can't be implemented in an adequate way because of price volatility, especially when the agricultural products are in play. Interventions should be extended to structural and institutional reforms, thus removing structural causes of inflation.

Finally, it should be added that in the process of globalization, internationalization of business activities and increasing integration on the international level, inflation is under the significant influence of movements that are manifested at the international market, primarily at the market of raw materials (energy) and agricultural and food products. Hence, agriculture can still be a significant factor in the growth of inflation caused by international trade as well as the underdevelopment of the two thirds of the world countries. Therefore, in such conditions, it shows a marked volatility in both quantitative and qualitative terms that is directly reflected in the movement of prices, which further affects inflation.

The role of prices

When it comes to inflation, prices are definitely an indispensable, even central topic. The most common are the so-called nominal prices as an element of equilibrium, whether individual or overall. Nominal prices are related to the so-called normal income. The analysis of the normal price and in this respect the market price is based on the following assumptions: the presence of complete competition, homogeneity of products within the industry, complete capital mobility and capitalist mode of production.

Hence the critique of both supply and demand as price determinants is based on a critique of the origin of the commodity value. Price theories in the so-called market economies are starting from the population that normal prices formed by the action of supply and demand forces. They consider that behind the supply are the average costs, and behind the demand, the subjective perception of the value of the goods i.e. their marginal benefit and income. The normal balance of the prices is derived from the balance on the side of the tenderer and the caterer.

In regular circumstances, individual bidders accept a normal price because they are not able to act on the side of supply and consequently demand. However, the theory of limited competition is using monopoly prices in which the monopolist, besides normal, also generates extra profit by manipulating with demand and

supply. The theory of market economy has made a significant contribution in explaining the equilibrium price phenomenon observed in different market structures. This phenomenon is reflected in researching the connection between price and demand (price elasticity), the interaction between prices (cross-elastic) and the dependence of the price equilibrium upon the social productivity of labor (normal price according to the rising, declining and constant costs), i.e. the impact of social productivity on the formation of prices in branches with increased, above-average and below-average social productivity of labor.

Agricultural prices could be characterized as the prices of the necessary product of the society that are influencing real income of agricultural producers as well the level of consumers and producers accumulation. They are not in direct proportion with the part of consumer's income dedicated to foodstufs purchase. For example, nowadays consumers in Serbia allocate's slightly less than 50% of their income for nutrition purposes[5]. On the other hand, prices arent a universal instrument for acting on agricultural producers (including international market prices). In addition to that, the orientation of agricultural production and its structure are influenced by other factors like loans, various subsidies, premiums, different reliefs, tax and contribution exemptions, etc.

Volatility of Agricultural Prices at the International Market

A number of factors have influenced the movement of agricultural prices in particular countries. Sometimes they are objectively conditioned, for example, the process of agricultural production globalization, financial and technology flows in different parts of the world during relatively short period of time, the monopolistic structure of the world market caused by the capital appreciation (the emergence of multi- and trans-national companies that conquer the world space, i.e. new markets, creating and expanding the network of business units in various countries), etc. The next factor which we emphasize is connected with strengthening of state's integration (economically powerful countries). Thus, there are situations in which the change in prices of agraricultural products on the international market is caused by various speculative actions. In addition to the above mentioned, important factors that are additionally influencing agricultural price changes, are as follows:

– an increase in demand for agricultural products in developing countries,

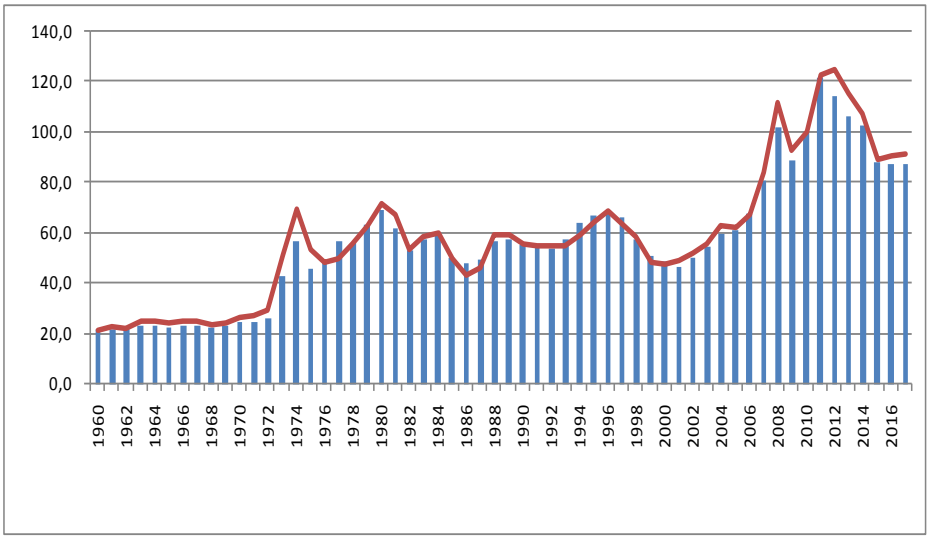
5 It is considered that if a third of the family budget is allocated for food purposes, then such a state is underdeveloped because only the basic needs of the family are met.

- a higher price of fuel and basic inputs of agricultural production,
- higher transport costs,
- the specificity of agricultural production caused by the influence of natural factors,
- redirection of field crops for alternative production (biofuels, etc.), and
- introduction of a food export restriction policy by some countries, etc.

The most important factor is on the side of field crops redirection for alternative production caused by the increased demand for those raw materials that are processed by renewable energy sources, especially in EU and USA (Mitchell, 2008:7). Some authors argue that an important factor of expansive monetary policy occurs in key industrialized countries, leading to low interest rates and a sharp decline in US dollar values (Frankel, 2006:22; Krichene, 2008:356). It should also be noted that the time of cheap foods has passed. This is indicated by changes in the movement of prices of agricultural products that are registered by the World Bank for a long period of time, Graph 1. The most significant is the increase in prices of agricultural crops that has increased in the last decades at the global level even four times (Pejanović, Njegovan, 2009:95).

As national market for agricultural products is under the influence of the international market, we emphasize that an effective national agricultural policy should have in mind two important determinants: *firstly*, that the raise of agricultural prices on the international market will affect national prices and therefore create inflation. In that sense, the difference in development between countries is the one that determines in which intensity these changes will be felt (due to the increased share of food in the consumer basket, the base inflation of the less developed countries is more endangered).

Graph 1. *Changes of gricultural and food prices at the International Market (1960-2017)*



Source: *World Bank Commodity data.*

Secondly, there is also an impact based on the expectation of future food price movements. As a result, pressure on the increase in wages is beginning. This leads to a rise in core inflation. Such events, in many countries and regions lead to a situation where the rise in food prices is higher than aggregate inflation, and thus to a greater extent contributes to inflationary pressure. For example, in Europe and Central Asia the total inflation was only 10% (before the crisis in the 2008), but the inflation in food prices was 15%, while the price of bread and grain was even 23% (Alam, Vybornaia, 2008:188).

Input prices, agricultural prices and global perspective

Volatility of agricultural product prices can also be explained by the change in the price of inputs, primarily energy products, Graph 2. This is the reason why the issue of food production and demand is directly dependent on energy supply opportunities in the long run. Therefore, it can be said that energy and food are factors that essentially define the inflation rate[6].

6 Energy and food prices achieve the highest degree of oscillation. The reason for this lies in the specificity of the products themselves (NBS, 2012).

Graph 2. *Trends in crude oil prices (1996-2010) US $ / barrel*

Source: *Statistical office of the European Union (www.ec.europa.eu)*

The global economic crisis of 2008 led to further redistribution of economic power on a global scale. Relative economic importance of the USA, Japan and the EU is decreasing and it strengthens the position of developing countries, especially the energy and BRICS countries (Brazil, Russia, India, China and the Republic of South Africa). Among the partially advanced economies, China is leading as it became the world's largest exporter, the world's second largest economy and the largest consumer of energy.

When it comes to prices of agricultural products, a number of other factors are influenced by them. First of all, the availability, or the limitation of the land resources used in agricultural production. It fixes its production capacity, which practically means that international supply is limited. In this way, under the pressure of population growth, the supply is limiting day by day. In addition, agricultural production is affected by natural conditions. They can to the some extent be controlled today. Also, there is a seasonal character of agrarian production. Also, we must not forget the importance of agricultural policy and its andvantages and limitations.

Our opinion is and the World Bank also forecasts that in the coming period, the tendency of price fluctuations will continue due to many global and internal factors in certain countries. This is confirmed by the fact that on tghe global level countries, for example spent on imports of food products US$ 1.290

billion (2011), that is 21% more than in 2010 (FAO, 2016). The estimations are that by 2050[7] food demand will grow between 70-100%, compared to 2010. On the other hand, the growth of agricultural production by 2020 is estimated at an average rate of 1.7% per year. This represents a decrease of 2.6% compared with previous decade. That could double cost of life (food) in two decades. Due to these tendencies food will be increasingly a strategic product in the coming period, which can significantly burden relations between individual countries of the world.

Due to all mentioned above, it can rightfully be said that the impact of agricultural and food prices on inflation is not only an economic but also a social issue, a topic that affects the very pores of society and its economic system. This topic is not up to date, but will be much more relevant in the future, especially when it is known how much will be the increase in demand for agro-food products[8] as a result of the world's population growth (doubled by 2050). Therefore, if there is no adequate response on the supply side, this will lead to an increase in the prices and thus create inflation.

The consequences of price growth and "pop up" of inflation

At the very beginning the next question might be posed: What is the maneuvering space of the Central Banks in meeting of the targeted inflation? When the conditions of the underdeveloped market mechanism are in play, the lack of fiscal and financial discipline and absence of a clearly differentiated structural policy in the real sector (these are the features of Serbian economy), wont bring price stability in the long run. In connection to that, it must be seen that agriculture represents an activity that provides food for the population - an aggregate supply of food, and in that sense affects relations that are established with aggregate demand for agro-food products. In this regard, the quantity of market surpluses that is used in other sectors is also relevant. The increase in these surpluses is necessary over time, *firstly* as an indicator of agricultural productivity increase, and *secondly*, for the nutrition of non agricultural sectors with cheap food, that

7 A meeting of the ministers of agriculture of the eight most important countries (Copenhagen 2008) sent a message of the necessity of increasing food production. Projections are given for the period until 2050, when production should be doubled (FAO, 2016).

8 In Europe, only Russia and Ukraine have higher natural resources for production in agriculture per inhabitant than Serbia and therefore an increase in food prices at the world market should act as a stabilizer of the national economy. However, in 2007 the highest growth of prices of basic food products in Europe was registered in Serbia.

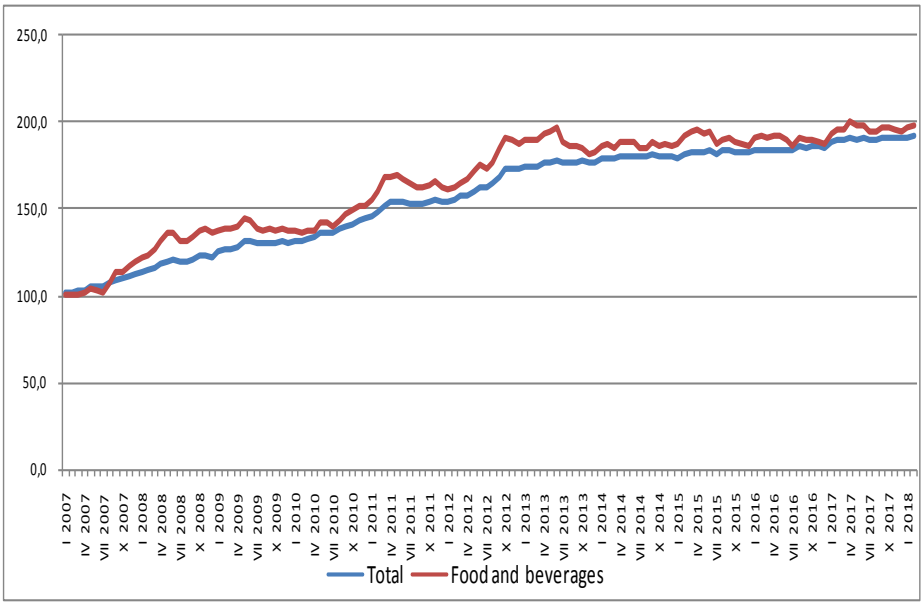
is the basis for maintaining relatively low wages (Njegovan et al., 2009:66-67). If agricultural prices are high, there is a pressure for raising the wages in the industrial sector (raising wages is unjustified because there has been no productivity increase). This necessarily causes inflation as a result of an increase in demand for agro-food products in conditions of relatively limited supply. Therefore, in the preservation of stability, the agricultural sector is inevitable, and for this sector the production strategy in the future is of fundamental importance.

It should also be noted that the inflation accounting system is today questioned, primarily due to the constant rise in food and energy prices. Their growth is no longer a passing phenomenon. We think that there is a complex change in the price relationship at the world market, because the rise in food and energy prices can no longer be seen as a reflection of short-term disorders. The high demand for raw materials, food and energy coming from developing countries, especially from China and India, as well the relative resource constraints and requirements for the sustainability of agricultural production, further affect the long-term observation of these processes. Based on this, it is estimated that there is a reciprocal influence (Fabris, 2006:389-405) i.e. that inflation has a decisive influence on the leveling of prices of agricultural and food products, as they in the further step rely on the household budget.

The impact of agricultural prices on the consumer price index in Serbia

At the very beginning it is necessary to point out several methodological notes. The price stability guard in Serbia is the National Bank of Serbia. Its government together with the National Bank defined the realization of core inflation, calculated on the basis of the retail price index (2006). Their proposal was that inflation has its planned value with the possibility of leveling, which also has its own interval. At the end of 2008, the inflation targeting regime was officially adopted, in agreement with the Serbian Government with the transition to targeting the overall consumer price index. The benchmark interest rate is used as the basic instrument of monetary policy. Since this instrument affects inflation with a time lag, the inflation targeting regime requires an ancillary asset to project (and forecast) inflation, but above all the path of the reference rate that should be followed in order for inflation to move within the target range. The model used in the National Bank belongs to a group of New Kensian models (Đukić et al., 2010:29). This model is based on the role of the monetary policy to maintain inflation in the prescribed framework. In purely theoretical terms, the consumer price index is one of the key areas of monetary finance and money theory, Graph 3.

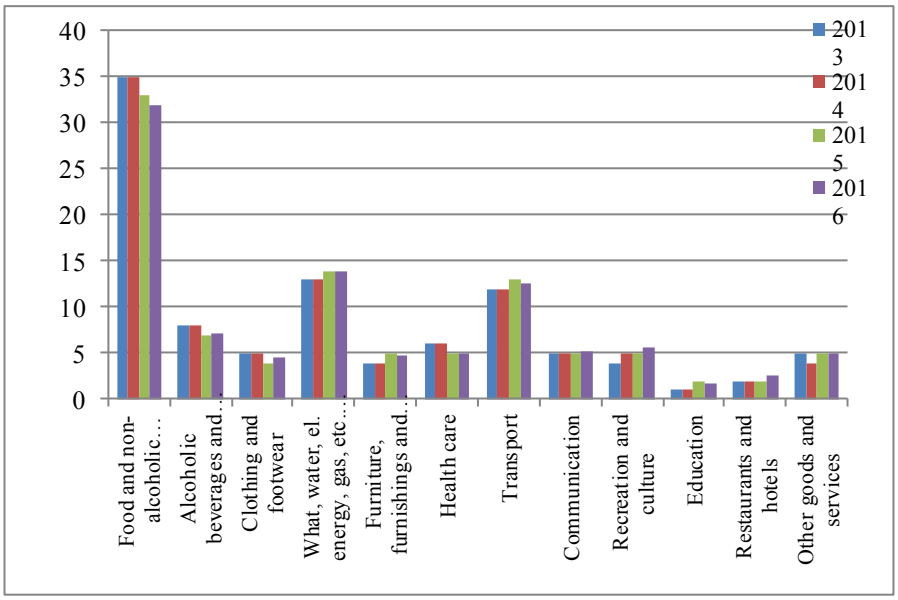
Graph 3. *Total consumer price index and food and beverage price index in Serbia (2006 = 100)*



Source: *National Statistical Beareu*

This index represents official measure of inflation, and for its definition the classification of goods and services of individual consumption is used, adjusted to the needs of the harmonized consumer price index. Products and services are divided into 12 divisions, while the total number of products and services is 606. When calculating, the key role belongs to the weights that reflect the structure of household consumption. The biggest share is weighted by the first division - *Food and non-alcoholic beverages*, with a share of 32 to 35% for the observed period. Graph 4 presents the weight structure for the period 2013-2016.

Graph 4. *The structure of consumer price indices (2013-2016 in %)*



Source: *Statistical Year Books for relevant Years*

In the basket of the consumer price index are present agricultural products that are in raw condition (a total of 38 individual products from the group of fresh and chilled fish, followed by a group of fruits, vegetables and eggs). Table 1, below are showing the structure of the individual agricultural products share for the period 2013-2016.

Table 1. *The share of agricultural products in the consumer price index*

Products-Years	2013	2014	2015	2016
Eggs	65	69	73	74
Purified walnuts, hazelnuts, almonds, chestnuts and the like.	29	22	20	25
Apples for food	50	45	39	35
Cherries and Sour Cherries	5	6	4	5
Garden strawberries	10	9	7	9
Raspberries	1	1	1	1
Apricots	2	4	2	3
Peaches	13	15	8	8
Plums for food	5	4	3	3
Grapes for food	15	13	11	11
Water Mellones	22	21	16	20

Products-Years	2013	2014	2015	2016
Lemon	11	12	10	12
Orange	24	21	19	18
Bananas	49	43	37	36
Mandarin	14	13	11	12
Grapefruit	2	2	2	2
Kiwi	4	4	3	3
Beans, beans, lentils	52	58	63	64
Onion	35	32	33	34
Carrot, pashkanat, celery, parsley root	22	20	21	20
Red rhubarb, rhubarb	6	8	6	5
Spinach, cabbage	12	10	10	8
Green salad of all kinds	13	13	13	9
Cabbage	31	30	25	27
Fresh cucumber	12	14	18	18
Garlic	11	10	8	6
Peas	3	2	3	2
Green beans	5	5	5	5
Fresh tomatoes	40	44	50	52
Paprika	51	49	48	48
Broccoli	8	9	9	7
Lean	5	4	5	4
Mushrooms	17	14	16	11
Zukinni, blue eggplant	9	10	11	8
White Potatoes	9	15	18	21
Red Potatoes	73	75	71	65
Carp	20	13	16	15
Fresh Trout	5	6	5	4

Source: *National Statistical Beareu*

In addition, it should be noted that a significant number of agricultural products do not enter directly into the calculation of consumer price indices, but serve as a basic input in the production of a final product such as wheat in the production of bread, sunflower in the production of edible oil, etc. That way the real significance of agricultural products remains hidden in a certain way is considerably higher. A wide picture of the importance of agricultural products in the formation of the consumer price index can be obtained by additional analysis of the share of industrial food products, Table 2.

Table 2. *Values of industrial food products ponders*

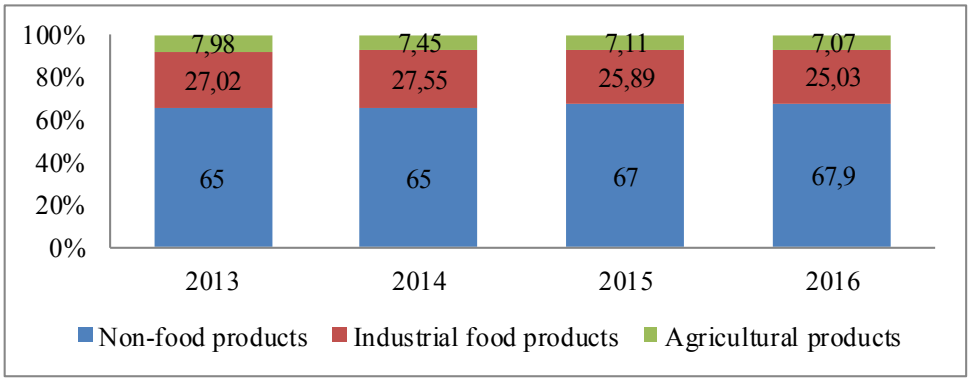
Products	2013	2014	2015	2016
Bread and cereals	510	525	482	491
- Rice	23	23	20	18
Meat	820	810	751	704
Fish and seafood	80	89	92	89
Milk, cheese and eggs	484	529	517	510
Oil and grease	103	100	79	78
Fruits	279	257	203	213
- Dried fruits, fruit in the shell and frozen fruit	44	36	27	35
Vegetables	402	508	415	383
Potatoes (red and white)	82	90	89	86
Other types of carob vegetable and their products	21	20	19	21
Sugar	70	65	46	45
Jam, marmalade and honey	23	23	21	21
Chocolate	44	45	66	66
Confectionery products	44	43	16	20
Ice cream	21	22	19	18
Artificial sweetener	0	0	0	1
Other food products	108	118	108	117
- Sauces, accessories	*38*	*41*	*38*	*40*
- Salt, spices and aromatic herbs	*40*	*45*	*33*	*39*
- Baby food	*5*	*4*	*8*	*5*
- Other food products	*30*	*28*	*29*	*33*
Coffee	128	132	136	123
Tea	7	7	6	7
Cocoa and chocolate powder	2	3	3	3
Mineral and spring water	58	59	52	58
Non-alcoholic beverages	79	80	70	77
Juices of fruits and vegetables	87	85	85	81

Source: *National Statistical Beareu*

The table contains the values of weighted food products (products used in raw condition and those that are based on agricultural products). The data indicate that the direct and indirect impact of agricultural product prices on the total consumer price index is unquestionable. That is of great importance for the creators of monetary policy that use the consumer price index as the basic measure of inflation. If for example the participation of agricultural products prices in the basket of the consumer price index is 8%, then the eventual increase in agricultural product prices of 10% directly increases the inflation rate by about 0.8%, assuming that the other conditions are unchanged.

In accordance with the above mentioned, it is worth to point out that for the observed period 2013-2016, agricultural products used in the raw state, are accounting for an average of 7.3% in the total ponder structure as a base on which the index of consumer prices is further formed. The data for the previously displayed data has been created, Graph 5. It presents the structure of the consumer price index.

Graph 5. *Structure of the consumer price index (2013-2016) - u %*



Source: *Calculation of Authors*

It can be noticed that the share of agricultural products in the total structure (the sum of all ponders of 10,000) decreases year after year, from 7.98% in 2013 to 7.07% in 2016. Also, there is a noticeable decrease in the share of industrial food products (by 2%), which ultimately results from a decrease in the share of the first division - *Food and non-alcoholic beverages* in the overall structure. In addition, the mentioned changes are minimal and clearly indicate that households in the Republic of Serbia are spending a third of their funds on a monthly basis on food. That is closer to the societies characterized by low quality of living standards.

Conclusion

In the Republic of Serbia, the total consumer price index which represents inflation, includes: core inflation with the largest share of over 60% then non-price inflation without oil derivatives and growth in oil derivatives prices. Hence, among other things, the volatility of prices of agricultural products has a significant impact on inflation. The change in food prices is consequently accompanied by the instability of production in the agricultural sector and affects the core inflation. Also one should not lose sight of the fact that agriculture affects inflation directly

and indirectly. Therefore, when it comes to setting goals for its development in a particular year, it is largely determined by the inflationary movement. This is due to the fact that food in the consumer price index is fairly represented. Agricultural sector significantly influences the formation of cost pressures on the prices of industrial food products because they are used as inputs (cereals, corn, soybean, sunflower, fruits and vegetables), and therefore, inflationary pressures should also be expected and vice versa.

It can be concluded that agricultural production in less developed countries such as Serbia has a higher impact on inflation. The importance of this topic is reflected in the fact that inflation in Serbia to a large extent burdens the movement of prices for agricultural products. The reason for this is the inadequate economic structure with agriculture as one of the dominating industries as well the unregulated economic system with the irrational spending of limited budget funds. They lead to imbalance and high inflation.

Finally, it should be said that price volatility and their impact on inflation can not be fully neutralized. In this sense, the starting point for solving the accumulated problems in the agricultural sector of Serbia is tied to its share in distribution of incentives for its growth and development. Possible solutions must take into account natural conditions, agricultural specificities, social and economic factors in order to minimize instability and inflation. The current state of affairs and problems that characterize Serbian agriculture and rural areas, make it difficult to deal with global challenges, among other things because the Serbian agricultural sector is under the strong influence of European highly competitive agriculture. It is therefore necessary to have a clear picture of the position and role of the agricultural sector.

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MODERN CHALLENGES OF ECOLOGICAL SUSTAINABILITY

Olgica Nestorović[1], Vesna Petrović[2]

Abstract

Sustainable development is a modern concept that implies economic growth and development in line with the social, economic and ecological component. In this paper, the author will analyze the effects of sustainable development on the ecological component, i.e. environment. The question arises whether the environment and economic growth are in positive correlation or not. In the past, we witnessed serious environmental threats at the expense of economic development. Today, economic development offers new opportunities for environmental protection by creating conditions for applying advanced environmental technology and management systems, but also by encouraging environmentally-friendly consumption models. Also, economic growth can contribute to sustainable development, but also cause enormous damage to the environment in the absence of the application of adequate measures.

Key words: *sustainable development, economic growth, environment, ecological component, ecological technologies.*

Introduction

Discussions on sustainability of development have been spurred by the increasing concern of the global community in terms of environmental degradation and the existing weaknesses of traditional models of development that have supported industrial modernization. The question of the way in which human, social and economic activities would coincide with the regenerative capacity of the global ecological system was at the center of attention, and for this reason, the interest in the concept of sustainable development, and therefore the environment, became more pronounced in the light of the process of globalization.

1 Olgica Nestorović, Ph.D., Assistant Professor, Faculty of Economics and Finance, Union Nikola Tesla University, Cara Dušana no. 62-64, 11000 Belgrade, Serbia, E-mail: olgica.n@yahoo.com

2 Vesna Petrović, Ph.D., Assistant Professor, Faculty of Economics and Finance, Union Nikola Tesla University, Cara Dušana no. 62-64, 11000 Belgrade, Serbia, E-mail: al.petrovicpn@gmail.com

Globalization creates new opportunities for developing cooperative relationships, but at the same time poses new issues and issues. For example, trade liberalization contributes to an increase in the rate of economic growth, which may result in an increase in pollution levels, including cross-border externalities and unsustainable consumption of natural resources. Economic integration strengthens competitive pressure across borders of the national economy, which contributes to the realization of consumers' interests by lowering prices, improving the quality of services and increasing consumer choice. However, such competitive pressure forces national governments to take regulatory action and condition the need for the implementation of inter-state coordination of national policies, as well as the need for cooperation in the area of global problems management. Without effective governance at the international level, globalization can intensify ecological damage and diminish the perspectives of sustainable development.

Alongside dynamizing the pace of economic growth and contributing to an increase in overall global output, globalization can impair prospects for economic prosperity in individual countries, sectors or industries. Such marginalization of people can result in excessive exhaustion of non-renewable resources and environmental degradation.

Globalization contributes to the spread of world production standards and can instigate a trend towards raising standards or a race to the top in environmental standards. On the other hand, in conditions of intense international competition, it is heightened and concerned about the loss of competitive ability due to the lack of fair competition or the application of poor standards, below the optimum level or race to the bottom in environmental standards. In addition, economic globalization changes the relationship between states and markets in achieving economic, social and environmental results. On the other hand, it asks for greater intergovernmental cooperation in governance as well as coordination of national environmental policies.

Interconnectedness of globalization and sustainable development

There is a high degree of interconnectedness and mutual dependence between globalization and sustainable development. Basically, the factors that trigger globalization are at the same time the driving force for sustainable development. For example, modern communication technologies contribute to accelerating change, while reducing the importance of traditional control mechanisms, while at the

same time increasing transparency and the ability to achieve global governance. They can improve access to relevant information, enable access to new knowledge, and facilitate the undertaking of necessary activities. Trade liberalization policies, which lie at the heart of globalization, help reduce the gap between rich and poor countries by accelerating the rate of economic growth.

The evolution of the global economy from international to global business is enabled, above all, by the growing flows of foreign direct investment and the expansion of the role of multinational corporations. The increasing role of multinational corporations and foreign direct investment, especially in global economic development, has led to the acceptance of the idea that these two entities are the main actors in the current globalization process, while their cross-border investment activities have significant positive or negative impacts on sustainable development (Nestorović, 2018).

Over the past several decades, the role of multinational companies as direct representatives of foreign direct investment in sustainable development has been one of the most controversial discussions among economists whose focus is on environmental issues and problems.

The views on the role of foreign direct investment in sustainable development vary and range from:

- those who proclaim them the main culprits for the growing ecological degradation and the unsustainability of current development models,
- to those who see them as the main driving force behind development and the leading factor in removing barriers that separate countries and hinder international economic relations, as well as factors that contribute to reducing differences in the level of development and achieving the vision of global sustainable development in the context of global change.

Environmentalists are critical of foreign direct investment and their relationship to sustainable development and environmental protection, and outline pessimistic views on their contribution to the protection and conservation of the environment in developing countries. In their opinion, driven by profit motivation, multinational corporations, as bearers of foreign direct investments, will reallocate eco-risk products from one country to another until they find the right market for these products.

Under the pressure of the burning development problems, the less developed countries are forced to prescribe weak environmental standards in order to attract foreign investors. Due to the high cost of alignment with tighter environmental standards in the developed world, developing countries will, therefore, become the ports for environmentally harmful industries of multinational corporations from the developed world.

These findings have been confirmed by a number of researches that supported the thesis on the reallocation of dirty industries to developing countries. For example, UNEP (1981) provided evidence of the relocation of some risky US industry to Mexico precisely thanks to environmental factors. For Corten (1995), therefore, "economic globalization provides greater opportunities for the richer to transmit their ecological intentions by poorer exports of waste and environmentally harmful factories." Mani and Wheeler (1998) indicate the migration of some Japanese dirty sectors, as well as American ones, to their trading partners. However, such a trend is not typical of developments within European industry. The disadvantage of environmental regulations can be a stronger side of foreign direct investment in these sectors compared with industries that are less intense in terms of pollution, such as electrical and non-electrical machinery, transport equipment and food production.Mabey and McNally (1998) point out that dirty industries, whether resource intensive or intense in terms of pollution, in which environmental costs are higher, can run to less robust environmental regimes. Similar evidence was also provided by Rasiah (1999), who analyzed the relationship between multinational corporations and the environment on the case of Malaysia, found that multinational corporations are transferring ecologically inferior machinery to Malaysia, due to lower ecological standards in Malaysia.

Unlike them, neo-liberal economists argue that multinational corporations are the most important drivers of sustainable development, since they appear as creators and owners of modern and environmentally cleaner technology, and because they follow a better managerial practice that can be directly transferred to their affiliations in developing countries. Consequently, instead of the pollution port, foreign direct investments through multinational companies create hazards of pollution in developing countries through the export of modern technology. "The available facts show that in some sectors hazards actually exist. This hypothesis is also confirmed in the energy sector, in which the use of newer and superior technology can bring significant environmental savings. "

By applying the energy efficiency indicators, as well as by applying the use of energy per unit of output, they have found that foreign ownership is associated with cleaner methods and lower levels of energy use. Also, there is evidence that foreign investment in the energy sector in China has increased energy efficiency and reduced emissions. This is because foreign direct investments are focused on the production and use of advanced technologies. Better management and strengthening competitive pressure on the host country market is also a consequence of the effects of pollution hazards.

Technological innovations as a driver of economic development

At a time of complex change, technological innovations are the leading driver of economic growth and the development of the economies of all countries. The diffusion of modern technologies is a key precondition for the rapid development of developing countries and countries in transition and their approach to developed countries.

However, modern technologies are not just an instrument for providing support in dynamizing the rate of economic growth and accelerating economic development. They also represent the basic instrument for improving the environment and ecological performance of developing countries and countries in transition. New production processes and products, depending on the degree of their ecological similarity, can contribute to minimizing "trade-off" between economic growth and environmental pressure by reducing the intensity of pollution of economic activities.

Changes in current models of production and consumption are crucial for the long-term sustainability of natural resources and the preservation of the quality of the environment. The development and application of ecologically similar technologies is considered to be the most significant element in achieving a transition to sustainable development. However, there is a big dilemma whether with the further diffusion of modern technology, ecological pollution will be reduced or will only come to the reoccurrence of ecological problems from one region to another or from one country to another.

Practice has shown that technological innovations with positive environmental impact can serve as a suitable instrument for minimizing and preventing negative impacts of anthropogenic activities on the environment. Examples of this kind in

the manufacturing sector and services related to:

- ecologically justified exploitation of raw materials,
- discovery and use of new sources of raw materials,
- replacement of raw materials with less scarce or renewable, less environmentally harmful resources,
- development and introduction of ecologically suitable consumer goods,
- development and introduction of new, economically justified technologies both in terms of resource consumption, as well as in terms of preventing harmful emissions,
- development and introduction of waste processing facilities and technologies for the rehabilitation of environmental damage.

In this respect, technological progress is a key factor in improving the state of the environment for at least four reasons:

1) Using modern technology in the production process increases the volume of production, reduces the cost of production factors and consequently realizes the effects of economies of scale,
2) Reducing the use of natural resources, using modern technology increases efficiency and rationalizes the use of each unit of spent resources in the production process,
3) A high level of production technology supports the production of those products that are less environmentally harmful when used or sold,
4) The application of modern ecologically similar technology is in function of reducing pollution emissions into the environment.

Mutual correlation between foreign direct investment and sustainable development

The link between foreign direct investment and technological changes is twofold: namely, foreign direct investment through multinational companies is the main actors in the development of technology, while at the same time, their activities are highly dependent on this development. In fact, technological development is a key factor that has contributed to the increase in the importance of foreign direct investment and global strategies of multinational companies, which are highly motivated by the need for control over the development and use of new technologies. These strategies show that increasing mobility of technological flows is induced by the activities of multinational corporations and that these enterprises are an important instrument for transferring technology to host countries.

Foreign direct investments, in addition to achieving potentially large effects on the rate of economic growth of the host country through different channels (through the impact on the quantity and quality of capital formation, technology transfer, raising the level of human capital development, expanding trade opportunities), also have an impact on the quality of the environment , with certain implications for the long-term sustainability of economic growth and the possibility of achieving sustainable development.

As the main promoters of research and development activities, as well as the holders of modern technology in the world, foreign direct investment today through multinational corporations has shown an increasing interest in researching and implementing environmentally friendly technologies. However, one should not ignore the fact that foreign direct investments today do not appear only in the unilateral role of technological innovators. They are also carriers of research and development activities, technological advances and also have knowledge, developed skills and techniques for safe manipulation, transportation, storage, use and disposal of toxic materials, as well as the development of technologies that reduce the level of waste and pollution.

Foreign direct investments in the form of multinational companies introduce modern ecologically sound technology into the host country directly, by investing in the establishment of affiliates or by selling technology to domestic producers and consumers. They can generate environmentally useful technology "spillover" effects, but also contribute to the increase of ecological efficiency, dynamism of competition in the market of the host countries. In addition, foreign direct investment imposes strict environmental requirements on its suppliers in the host country, which encourages them to adopt good environmental regulations, standards and management practices in the implementation of their activities. However, the environmental impact of incoming foreign direct investment is not the same in all sectors of an economy. Investments in environmentally sensitive sectors have far more impact on the level of eco-efficiency of the host country than those that are being realized in relatively inconsistent (cleaner) economic sectors.

Foreign direct investment does not only realize the transfer of environmentally-friendly technologies to their affiliations in the host country. Through foreign direct investments, they also transfer a more efficient environmental management system to suppliers, consumers and local enterprises in the host country, both on the basis of the demonstration effect and on the basis of the application of solid environmental standards.

The economic and environmental benefits of applying preventive pollution prevention measures are several times higher than some traditional solutions. Practical research shows that environmentally-friendly technology is not only economically and ecologically cost-effective but also contributes to the achievement of additional benefits. For example, its application can contribute to alleviating some of the social problems, such as unemployment and poverty, in the host country. The introduction of qualitative novelties into the corporate environmental management system is based on replacing the traditional approach, which is aimed at correction, a new approach aimed at ex ante environmental protection against pollution.

In addition, foreign direct investment can contribute to achieving the goals of sustainable development and transfer of environmental managerial knowledge and skills through the recruitment of foreign managers in affiliates in the host country. By making the available knowledge and lessons available less locally, foreign direct investments contribute positively to increasing the capacity of the eco-management of the host country. Therefore, it is not surprising that for developing countries, especially those that do not have resources for technological innovation, multinational corporations are not only important factors for sustainable development, but also the only realistic chance for its realization. However, a positive contribution of multinational corporations to sustainable development can be achieved only under the condition of the existence of such a regulatory system in the host country that actively promotes the sustainable behavior of foreign investors and contributes to the attainment of mutual interests: both the profitable motivation of foreign investors and the goals of sustainable development of the host country.

In order to ensure that foreign direct investment does not cause significant environmental damage, it is necessary to build the regulatory capacity of most countries so that it is able to implement and be consistent with higher national and international environmental standards. Improving standards can simply include better application of existing environmental impact assessment legislation or investor policy rules. Attention should be focused on the functioning of institutions at the meso level (regional, municipal and local authorities), because at these levels direct planning, resource use and private activity are directly controlled. However, given the cross-border nature of environmental problems, the creation of such a regulatory system that would allow greater flexibility and the ability to control environmentally-risk foreign direct investment projects of multinational corporations requires the development of an adequate institutional infrastructure not only at the national but also at the regional and international levels.

Foreign direct investments realize their impact on sustainable development and environmental protection directly through multinational corporations and their role is extremely important in this regard (Nestorović, 2017).

Increasing the impact of multinational corporations and their role in shaping development perfomances can be traced back to the 1970s when their cross-border activities begin to follow the trend of explosive growth. Judging by the available data, the period 1970-2010. The year is characterized by an upward dynamic of growth in the activities of multinational companies. This statement is confirmed by the increase in the number of multinational corporations: in 1970 only about 7,000 multinational corporations operated, their number increased to 63,000 parent companies in 2000, with some 690,000 affiliates abroad, while today 103,786 multinational corporations operate worldwide which control about 892,114 affiliations overseas.

Observed by size and economic strength, it can be concluded that multinational corporations have a large capacity to influence the development of development policies in host countries. Practice has confirmed that, owing to the many expected development benefits that accompany the activities of multinational corporations, economic and political decisions of host governments are often brought in favor of the invetions and market needs of multinational corporations. In such a situation, the question is whether the enormous corporate strength diminishes the perspectives of sustainable development by circumventing the host country's ecological standards. In addition, the fear of reallocation of investment activities and the abandonment of the host country, as well as the expected negative development effects of such developments per host country, can have a decisive impact on the level at which developing countries set environmental regulations regulating the activities of multinational corporations.

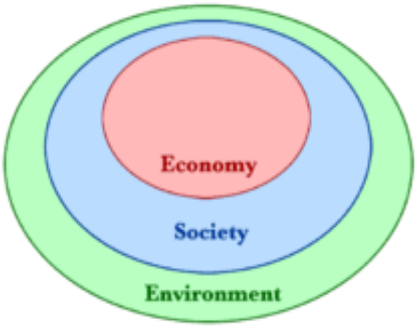
Foreign direct investments until the 1980's were considered as drivers of the development of the global economy. To such an opinion on their role in development, the attitude of free-market economists was largely influenced by the fact that multinational corporations are legally responsible only to their shareholders for the financial performance of the corporation. (Friedman,M., 1970.) Accordingly, the belief that multinational corporations represent exclusively profit-oriented entities, which do not have any legal obligation to incorporate social interests into their activities, has dominated. Milton Friedman explicitly supports this opinion in his work „The Social Responsibility of Business is to Increase its Profits", because

there is one and only social responsibility of the business - the use of resources and engagement in such activities that are designed to they increase their profits. However, after a series of ecological disasters directly induced by the activities of multinational corporations during the 1980s, and by matured awareness of the dependence of human survival on the quality of the natural environment, there was a radical change of opinion on the role of multinational corporations in development. Assuming multinational corporations to be the main drivers of environmentally-hazardous activities, many researchers call into question the traditional model of business practice, inviting multinational corporations to set the long-term sustainability of the environment to a high place in the ranking of priorities along with their profit interests. This idea of aligning corporate interests with environmental protection has given impetus to defining concept of sustainable development.

There is a belief that countries that are intensively engaged in the production process generate more pollution. Discussions on the impact of environmental regulations on the sustainable behavior of foreign investors have arisen with increasing differences in environmental regulations between developed and developing countries. This problem also got the significance that the activities of developing countries began to show signs of unfair competition by reducing regulations (Petrović-Ranđelović, 2007).

For a long time, researchers' attention has been occupied by the potential negative environmental effects of cross-border activities of multinational corporations on developing countries. The biggest debates were focused on the question of whether multinational corporations are carrying out the relocation of environmentally harmful production to developing countries in order to achieve cost savings, ie benefits from the application of weaker regulation on environmental protection. However, surveys conducted on the hypothesis of pollution ports have not provided enough convincing evidence to provide the basis for concluding that multinational corporations follow ecologically harmful practices in the implementation of cross-border investment activities in developing countries. This is especially due to the fact that "environmental costs are not key factors in deciding on the location of investments. In spite of the fact that cost effectiveness can be a significant driver of cross-border investment activities, multinational corporations show a greater inclination to carry out activities in a country with an adequate ecological framework than in a poor country. If companies undertake investments that improve the environment, many production costs will be reduced by improving the quality of the environment.

Figure 1. *Ecological sustainability*



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Some researchers believe that multinational corporations do not apply even better or worse environmental practices than local businesses in the host country. In a comprehensive survey conducted by UNCTAD (1988), it has been established that the number of industrial accidents has increased over the last fifty years, with available data suggesting that in less than half of these unfortunate circumstances, multinational corporations were involved. A large number of accidents have just happened in national or state-owned enterprises. However, even if multinational corporations follow lower environmental standards in the rationalization of investment activities in developing countries, there is plenty of evidence that their ecological practices in developing countries are more reliable and responsible than the practice followed by local businesses.

In the field of environmental protection, two legal documents of the European Union are of particular importance. These are: the 2000 Lisbon Strategy (revised 2004) and the 2001 European Union Strategy for Sustainable Development (revised 2006).

These documents link the environment with economic and social development (Jelinčić, Đurović, 2009:20). In individual legal documents adopted at the level of the European Union, certain aspects of environmental protection are considered. This includes the protection of: water, air, soil, human and animal health,

plant protection, etc. It explicitly does not mention certain goods that come into the sphere of environmental protection, but specific plans and programs to protect it are identified. This is, for example, the case with the EU Directive 2001/42 / EC on the assessment of the impact of plans and programs on the environment. Its goal is to achieve a high level of environmental protection and contribute to the inclusion of factors important for the environment and the process of preparing and adopting plans and programs in order to promote sustainable development. It can be achieved by ensuring the adoption of appropriate plans and programs where there is a potential for significant environmental impact.

This is especially important when there is an objective possibility of creating significant environmental impacts (Prlja et al., 2012:161-162).

In its strategic documents, the European Union has particularly emphasized the need for environmental protection, regardless of the area of human activity. The current European Union's Development Strategy (Europe 2020) defines key objectives in the area of sustainable development. They are dedicated to the efficient use of available resources in a way that protects the environment (Ilić et al., 2017:45).

Although there are a wide variety of European legal instruments, it is not possible to establish a precise definition of the environment. It could be said that there is as much definition of the environment as the authors dealing with her study. A similar situation is in terms of European regulations regulating the environment. Therefore, the valid legal instruments used by the European Union to improve the position of the environment could be divided into two categories: a) as a set of objective, material standards, relating either to the establishment of a limit on the emission of harmful substances or to the prescribing of concrete standards of product or process quality Production; B) as a set of rules relating to different procedures within the framework of environmental management, such as monitoring procedures for air or water pollution, rules relating to the transparency and accessibility of environmental data (Jelinčić, Đurović, 2009:22).

Making decisions, while respecting potential environmental consequences, is important at different levels, ranging from strategic to operational work. In addition, the types of decisions in which to consider the environmental impact are in the areas of strategic planning and capital infrastructure investments: the construction of certain industries, green buildings, waste management; Eco-design and

product development; Operational management - the introduction of green public procurement (Stevanović Čarapina, 2014: 28). They set up areas in which it is necessary to establish legal mechanisms in countering various forms of environmental degradation. This implies the application of principles and principles that have universal validity. An important step in this direction is the definition and application of the precautionary principle on which all EU regulations must be based (Tubić, 2014:372).

In the European Union's legal instruments, the right to a healthy environment has never been treated as an essential right, but it is working on its development as procedural and participatory law - through the right to participate and the right to legal redress.

The Union views the environment beyond national boundaries, treating it as a regional problem (Kostic, 2009:220). It is necessary to bear in mind the fact that environmental pollution can not be resolved in the national context, since, in the end, the final outcome of the procedural part of the protection is made by the European Court of Human Rights.

Conclusion

It is widely accepted today that multinational corporations, when implementing their cross-border investment activities, use standardized technology and environmental management systems, regardless of the degree of development of the host country and the level of implementation of environmental regulations. Such behavior can be explained by the following reasons:

- purely profit motive lies in the basis of such behavior, since the application of the same technology leads to cost savings, due to the increase in international business efficiency and the achievement of higher productivity,
- the application of ecologically clean technologies and the respect of clearly defined environmental standards in the country of origin in affiliates abroad, contributes to strengthening the reputation of the corporation among consumers, but it is also an instrument for ensuring the risk of bringing legally accountable liability in case of industrial incidents.

Multinational corporations are increasingly engaged in equalizing business conditions not only by applying the same environmental standards in their affiliations and abroad, but also by imposing stronger environmental demands on local suppliers involved in the global production network. These commercial environmental

requirements are voluntary, but "de facto "binding on local suppliers in order to effectively integrate them into the corporate network of production, rational and profit-oriented foreign investors can anticipate raising environmental standards over time in a host country characterized by a less stringent regime of environmental regulation.

As a result, in the initial investment phase, they implement modern technology to avoid large cost adjustments in subsequent phases of the life-cycle of the investment,

If multinational corporations have similar capacities in countries with higher and lower ecological standards, they find it more useful to introduce the same pollution mitigation technology in countries with lower environmental standards. This is because the costs of dismantling the already introduced technology can outweigh the benefits of cost savings to mitigate pollution.

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ECONOMIC SUSTAINABILITY OF DAIRY PROCESSING SECTOR IN SERBIA

Rade Popović[1], Dalibor Panić[2]

Abstract

The main goal of this paper is to explore economic sustainability of dairy processing industry in Serbia during 2016. The focus is on several indicators of economic dimension of sustainability. From over 100 dairy companies 79 are examined, to reveal its competitiveness, according size and business strategies applied by companies in relation with other participants in milk supply chain. As a main performance indicators for competitiveness estimation are chosen productivity and efficiency. Results revealed that foreign owned big and several middle sized company with strategy focused on vertical coordination of activities with dairy farmers, reached highest level of labour productivity and technical efficiency. On other side results imply sources of lower competitiveness in other dairy companies.

Kay words: *sustainability, dairy processors, competitiveness, efficiency, productivity, Serbia*.

Introduction

Dairy sector across world facing several challenges. Restructuring and constant growth of dairy processing companies on international and in some cases intercontinental level are main characteristics. Ownership of dairy processing companies on world level is dominantly cooperative, but three the biggest are private companies. Regardless of ownership type they adjust their strategies to response on globalisation challenges.

Economics of scale become more important for dairy processing companies, but also for farmers. Last happenings caused with low milk price in USA market

1 Rade Popović, Ph.D., Associate Professor, University of Novi Sad, Faculty of Economics in Subotica, Department of Agricultural Economics and Agribusiness, Segedinski put no. 9-11, 24000 Subotica, Serbia, Phone: +381 63 8041 301, E-mail: popovicr@ef.uns.ac.rs

2 Dalibor Panić, Ph.D. student, University of Novi Sad, Faculty of Economics in Subotica, Department of Agricultural Economics and Agribusiness, Segedinski put no. 9-11, 24000 Subotica, Serbia, Phone: +381 64 84 22 121, E-mail: dalibor226@gmail.com

pushed dairy farmers with less than hundred cows out of business (USDA, 2018), especially in case if they were not secured under cooperative umbrella.

During period of transition in Serbian dairy sector processors lost market power and retailers gain it (Popovic, Radovanov, 2010, Popovic et al., 2017). In Serbia cooperative dairy processing capacities do not exists (Popovic et al., 2017). All dairy processing companies are private. During transition period foreign investors take control and ownership on 67% of dairy processing business, according share in business revenue. There are presented Mid Europa investment found, Lactalis, Meggle, Bongrain, and Bonafarm while some others showed interest to invest in Serbian dairy sector in future. Rest of 33% of dairy processing industry are domestic owned and significantly smaller in average size than those owned by foreign companies.

The purpose of this paper is to measure efficiency among Serbian dairy processing companies according business size, strategy and ownership in 2016. The objective is to identify the most efficient dairy companies in Serbia as precondition for later on measure of efficiency with companies in other neighbouring countries.

Economic sustainability is complex issue and in this paper it will be measured with efficiency as its component. Economic efficiency is product of technical efficiency (TE) and allocative efficiency as it is defined by Farrell (1957). Technical efficiency is principal element in economic profitability as it measures the ability of the firm to produce maximal output from a given set of inputs. This will be reflected in the average cost of operation and, hence, will directly affect the competitive position of the firm (Ben-Belhasenn, 2000). Allocative efficiency reflects the ability of the firm to use the inputs in optimal proportions, given their respective prices. The allocative efficiency is necessary if the firm maximizes its profits or minimizes its costs at a given level of production (Ouattara, 2012).

Studies of efficiency in dairy sector are numerous and mostly focused on dairy farms. Recently dairy processing industry came in focus. There is three main directions in research: efficiency of dairy companies in one country (Vlontzos, Theodoridis, 2013; Popovic, Panic, 2018; Popovic et al., 2018), efficiency differences between cooperatives and investor owned companies (Soboh et al., 2014), and efficiency differences between dairy sectors in various countries (Baran, 2013; Špička, 2015). In studies of dairy processing sector efficiency the most applied method is Data Envelopment Analysis, while some authors use Frontier Stochastic Analysis.

Material and methods

Data used for technical efficiency analysis of dairy processing companies in Serbia are acquired from financial reports of 2016, published by Serbian Business Registers Agency (SBRA). Financial and production data are collected for over one hundred dairy companies in Republic of Serbia. This research allied on research results focused on previous 2015 year (Popovic, Panic, 2018). Total number of dairy processing companies decreased from 2015, since one middle sized company was acquired by big one, and several micro dairies sized production. The sample in this research includes 79 dairy processing companies. Number of dairies in sample represent 99.7% of all dairy companies in Serbia that published financial reports in SBRA, measured in total business revenue. According to Law on accounting of the Republic of Serbia, 40 of them is classified as micro, 28 small 9 medium scale enterprises, and 2 of them classified as big enterprises. There are several reasons why not all dairy processors were included in sample. Some micro dairies do not have obligation to publish financial reports, some dairy processors are just small piece of total business presented in financial reports and in some cases dairy processors done business without labour and material costs.

Dairy processing companies in Serbia adjusting their strategies in milk supply chain as answer on external opportunities and threats. In 2016 each dairy processor applied one of several identified strategies. Basic strategies of dairy companies identified on Serbian market are:

1. Specialisation in milk processing. Row milk is provided on market through collecting stations without strong contract with farmers. Milk products are sold to wholesale or retail chains.
2. Vertical coordination with dairy farmers. Dairy processor is developing long term coordination of activities with dairy farmers to secure through strong contracts row milk market by quantity and quality. Dairy products are sold to on domestic or international market.
3. Partial vertical integration with dairy farm sector. Processor build or buy dairy farm or farms and provide significant amount or row milk for own processing capacities. Dairy products are sold to wholesale or retail chains.
4. Complete vertical integration. Fully integrated dairy chain with owned dairy farms, processing capacities and network of small dairy shops.
5. Partial vertical integration with small dairy retail shops. Focus on milk processing and sale of dairy products through own small dairy shops.
6. Dominant share in revenue from resale farmers dairy products.

Productivity and efficiency are often used interchangeably although they are not same things (Coelly et al., 2005). Productivity is ratio of output(s) that company produced and used input(s). It can be expressed as total factor productivity or partial productivity as it is labour, land, capital, productivity. Although partial productivity measures can provide misleading indication of overall productivity some authors agree that in labour intensive industry, as it is dairy, labour productivity is still adequate measure. In measure of microeconomic efficiency on firm level the most used method in literature is Data Envelopment Analysis (DEA). Method was developed almost two decades after Farrell defined basic economic efficiency concept. Charnes, Cooper and Rhodes (1978) developed first DEA model with Constant return scale (CRS).

For analysis of technical efficiency in Serbian dairy processing sector is chosen DEA input oriented, multi stage model with variable returns to scale (VRC), developed by Banker, Charnes, Cooper (1984). Comparing to the model with CRS it is more adequate to assume VRC approach since imperfect competition, government regulations, constraints on finance etc., may cause a firm to be not operating on optimal scale (Coelli et al., 2005). Each company in sample is treated as decision making unit (DMU), although some authors prefer term "firm". Model assumes data on N inputs and M outputs for each I DMU. For the I-th DMU these are represented by the column vectors x_i and q_i, respectively. The N x I input matrix and the M x I output matrix, Q, represent the data for all I DMU. For each DMU ratio of all outputs over all inputs could be obtained by $u'q_i/v'x_i$, where u is an M x1 vector of output weights and **v** is a N x1 vector of input weights. The optimal weights are obtained by solving mathematical programming problem:

$$\max_{u,v}(u'q_i/v'x_i),$$
$$\text{st}^3 \quad u'q_j/v'x_j \le 1, \quad j=1,2,...,I,$$
$$u, v \ge 0.$$

Values for **u** and **v**, such that the efficiency measure for the i-th DMU is maximised, subject to the constraints that all efficiency measures must be less than, or equal to one. To avoid infinite number of solutions in the ratio formulation it is necessary to impose constraint $\mathbf{v'x_i = 1}$, which provides:

3 "st" stends for Subject to

$$\max_{\mu,v}(\mu' q_i),$$
$$\text{st} \quad v' x_j = 1,$$
$$\mu\, ' q_j / v' x_j \leq 1, \quad j=1,2,...,I,$$
$$\mu, v \geq 0.$$

Change of notation from **u** and **v** to **μ** and ***v*** is used to stress that this is a different linear programming problem. Using duality in linear programming and convexity constraint **I1'λ= 1** DEA model is derived in form:

$$\min_{\theta,\lambda} \Theta,$$
$$\text{st} \quad -q_i + Q\,\lambda \geq 0,$$
$$\Theta x_i - X\,\lambda \geq 0,$$
$$I1'\lambda = 1$$
$$\lambda \geq 0,$$

where I1 is an *I* x 1vector of ones (Coelli et al., 2005). Linear programming problem must be solved I times, once for each DMU in the sample. A value of Θ is than obtained for each DMU.

The proposed DEA model enable calculation of CRS and VRS models for each DMU, that presents technical efficiency (TE) and pure technical efficiency (PTE) respectively. Scale efficiency is the ratio of TE and PTE. If ratio is equal to 1 than DMU is scale efficient, otherwise results lower than 1 indicate scale inefficiency. Also TE and PTE are bounded by zero and one, where coefficient one stands for efficient DMU.

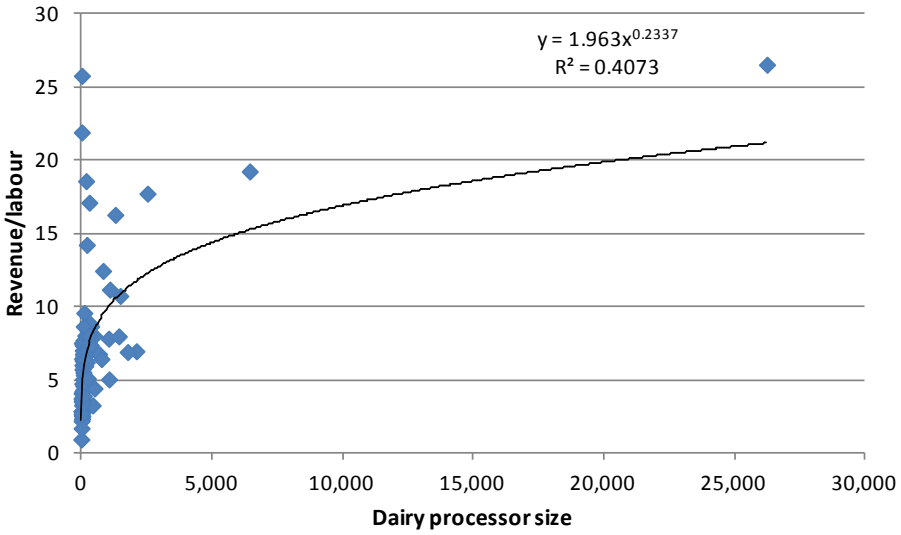
Results

Data presented in Graph 1. explain labour productivity trend in dairy processing sector in Serbia during 2016. Coefficient of determination for the power trend reveals moderate positive correlation between partial labour productivity and business size. It can be inferred that with increase size of business labour productivity also increase.

Variables chosen for DEA model covers all dairy business and counts five in total, one output and four inputs. As output variable is selected total business revenue, that include revenue from sales of products and services and revenue from sale of goods.

Input variables used in DEA model decreased on lowest number, cover all input side of dairy processing business. First one input variable is cost of material, which is dominant cost component in the most dairy companies. As input variable it includes cost of all purchased materials used in production process. In the structure of material cost, raw milk purchased from farmers have the biggest share. Cost of raw milk as main input could have share in total cost of dairy companies, ranging from 60% to 80%, depending on plant size and production structure (Popovic, Knezevic, 2010; Thiele, 2008).

Graph 1. *Productivity of 79 Serbian dairy companies in 2016.*



Source*: Data obtained from SBRA.*

Second input, labour cost includes all range of cost varieties connected with labour used in dairy plant. According share in total production cost in dairy business it is second large cost. Third input is energy cost. All energy cost in raw milk transport, milk processing and transport of dairy products to market are included in this category. Fourth input variable is category of other costs. It includes five costs categories: depreciation, cost of purchased commodities, contracted services, non-material cost, and interest paid.

Table 1 provide descriptive statistics for output and input variables of dairy industry in Serbia during 2016. There is huge variation of data from micro to big dairy companies, while cost shares in each DMU are relatively stable. In few cases mi-

cro dairy processors do not have material cost or energy cost, what is aligning with strategy 6 and outsourcing transport service.

Table 1. *Descriptive statistics for variables of 79 DMU in 2016, used in DEA method.*

Variable	Mean	Standard deviation	Minimum	Maximum
Return	717,035	3,030,773	1,873	26,237,653
Material	385,386	1,500,852	0	12,926,992
Labour	56	126	1	989
Energy	26,491	91,778	0	777,823
Other cost	195,900	910,215	374	7,901,067

Source: *Data from financial statements of dairy companies published on SEBRA*

Data in Table 2 reveal situation with strong correlation coefficients between inputs and output data. The strongest correlation exist in relation revenue and material cost, what is expectable, since row milk as main input have 54% share in total cost of dairy plants for all DMUs in sample. Sarkis (2007) as several other authors (Pastor et al., 2002; Ruggiero, 2005) propose that number of highly correlated inputs or outputs can be reduced in case of high correlation, in DEA model. But also warns that even in cases of perfect correlation of variables, results of efficiency estimate can slightly differ.

Table 2. *Correlation analysis of input and output variables for 79 DMU.*

	Revenue	Material cost	Labour cost	Energy cost	Other cost
Revenue	1				
Material cost	0.9985	1			
Labour cost	0.9918	0.9926	1		
Energy cost	0.9390	0.9504	0.9603	1	
Other cost	0.9952	0.9893	0.9807	0.9155	1

Source: *Author's calculation based on SEBRA data.*

DAEP 2.1 program (Coelli, 1996) was used to estimate DEA model with relative efficiency in sample of dairy processing companies in Serbia in 2016. Input - oriented multi stage model with variable return to scale was chosen for analysis. The results of CRS and VRS DEA models present TE and PTE respectively. Scale efficiency is calculated as the ratio of TE and PTE.

The results of estimated DEA models for 79 DMUs, with CRS and VRS are presented in Table 3. Average TE calculated with CRS assumption is 0.899, where 18 DMUs scored $TE_{CRS} = 1$, mostly in groups of micro, small and middle sized dairy companies, as well as big one. Decomposition of TE_{CRS} on PTE and scale efficiency revealed additional set of results.

Table 3. *Technical efficiency scores by DEA method of 79 Serbian dairy processors in 2016.*

Enterprise size	DMU	CRS TE	VRS TE	Scale	
Micro	40	0.888	0.911	0.976	irs
Small	28	0.907	0.920	0.985	drs
Middle	9	0.899	0.926	0.971	drs
Big	2	1.000	1.000	1.000	
Mean:		0.899	0.918	0.979	

Source: *DAEP 2.1 program results*

DEA model estimated with VCR assumption have slightly higher efficiency 0.918, while number of DMUs with $TE_{VRS} = 1$ increased to 30 DMUs, where additional increase comes from groups of big, middle sized and small dairy companies. Considering this model, treated as PTE, results imply that inefficient companies may reduce inputs without a reduction in output. It is particularly important in case of micro dairies which are most input inefficient, and where inputs can be reduced for 9.9%. In group of small sized dairies inputs can be reduced by 8%, while in group of middle dairies inputs can be reduced for 7.4%, keeping same level of output. The two biggest dairies are proved as most efficient in inputs use.

All dairy companies beside those 18, which are technically efficient, have another way to improve business results by changes in scale of business. Scale efficiency coefficients lower than one implying inefficiency. In the group of micro dairies (Table 3) the most of inefficient DMUs operate under increasing return to scale conditions. That is because those dairies are too small in its scale of operation, and way to increase its productivity is to increase size of business.

The most of scale inefficient dairies in groups of small, and all dairies in groups of middle and big dairy plants operate under decreasing return to scale conditions. 24 Companies from those three size groups are over dimensioned, i.e. above optimal productive scale. Approach to increase productivity to optimal level for this group

of dairy companies is to decrease in size. Two the biggest dairy companies have in average pure technical efficiency score.

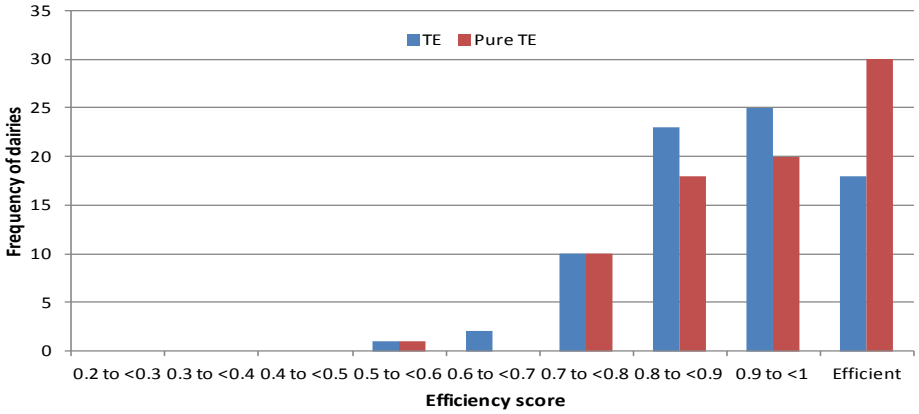
Table 4. *Technical efficiency scores by DEA method for domestic and foreign owned processors in Serbia for 2016.*

	DMU	CRS TE	VRS TE	Scale
Domestic	74	0.896	0.916	0.979
Foreign	5	0.943	0.956	0.986

Source: *DAEP 2.1 program results*

Comparing dairy companies by ownership it can be referred that foreign companies are more efficient than domestic (Table 4). Two big foreign owned companies are technically efficient, scored $TE_{CRS} = 1$. DEA model estimated with VCR assumption have slightly higher average efficiency 0.956 for foreign DMUs, where score $TE_{VRS} = 1$ performed by 4 DMUs. Only fifth dairy company with the smallest capacity scored with significantly lower level efficiency. Domestic companies have lower average efficiency in both cases, under CRS and VRS assumptions. Since domestic owned companies participate with only one third in total milk processing industry its lower efficiency do not have dominant influence on whole dairy processing industry efficiency.

Graph 2. *Efficiency score distribution of 79 Serbian dairy companies in 2016.*



Source: *Data obtained from DEA analysis.*

In Graph 2 are presented efficiency score distribution. From all dairies in sample 13 company have more significant problem with TE scored lower than 0.8, while 11 of them have lower PTE than 0.8. Those companies are mainly from group of micro and small dairies, while two are from middle sized dairies. It is important to emphasise that TE and PTE dairies exists in all range of company size.

Table 5. *Business strategies distribution for 79 Serbian dairy processors in 2016.*

Strategy	Micro	Small	Middle	Big	Total:
1	23	21	5	0	49
2	0	0	2	2	4
3	1	1	0	0	2
4	3	1	1	0	5
5	6	4	1	0	11
6	7	1	0	0	8
Total	40	28	9	2	79

Strategies practiced by dairy processing companies in Serbia are presented in Table 5. The first strategy, specialisation in milk processing, is most applied among all size groups except biggest dairies. Strategy number 2, dominantly oriented on vertical coordination of dairy processor with dairy farmers is in use among 2 big and 2 middle sized companies. The third strategy is practiced only by 2 companies, although several other companies tried this strategy in recent past. Strategy number 4 presents complete vertical integration is practiced from 5 dairy processors. Strategy 5 is second choice among dairy processing companies from different size groups. The last one strategy is practiced dominantly from side of micro dairies.

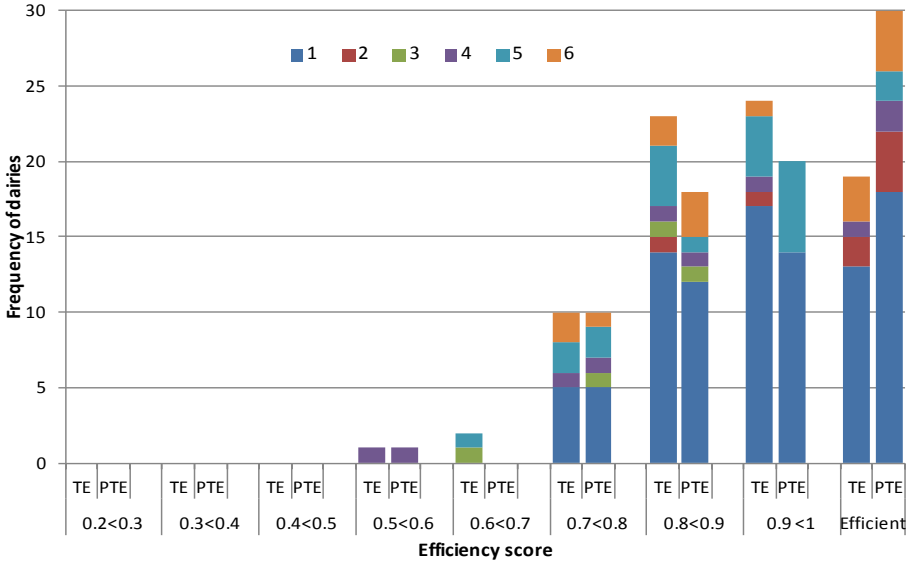
Table 6. *Technical efficiency scores by DEA method for applied business strategies of 79 Serbian dairy processors in 2016.*

Strategy	DMU	CRV	VRC	Scale	Rang
1	49	0.918	0.931	0.986	2
2	4	0.967	1.000	0.967	1
3	2	0.780	0.791	0.987	6
4	5	0.801	0.817	0.981	5
5	11	0.861	0.906	0.954	4
6	8	0.894	0.916	0.975	3

Source: *DAEP 2.1 program results*

Data for achieved average TE and PTE efficiency by applied business strategies presented in Table 6. During 2016 the most efficient strategy was vertical coordination strategy, numbered by 2. It is strategy that compensates lack of cooperatives in Serbian dairy sector. Similar conclusion prevails in numerous literatures from researches within agribusiness sector (Dries, Swinnen, 2004; Reardon et al., 2009; Dries et al., 2009). Vertical coordination between processor and dairy farmers is beneficial for both sides. Processor in long term stabilises row milk market by quantity and what is even more important by quality, while reach higher quality standards for dairy products and stabile production. Farmer on other side reach stable market and extension service leading his milk production to higher quality and bigger price. It should be noted that vertical coordination was existing in case of big and some middle sized dairy companies even before process of privatization and inflow of foreign direct investments.

Graph 3. *Efficiency score distribution of 79 Serbian dairy companies by applied business strategies in 2016.*



Source: *Data obtained from DEA analysis*.

Efficiency score distributions for 79 dairy companies according applied business strategies are presented in Graph 3. The most variable efficiency results achieved companies implementing strategy 4. Next one strategy by variability is number 5. The most applied strategy from dairy companies in Serbia,

strategy one, have also variable results in efficiency scores. Dairy companies practicing strategy 2 as most efficient in Serbian dairy business have the lowest variability of achieved results.

Conclusions

Dairy processing industry was facing significant globalisation challenges in recent decades. In Serbia dairy processing companies had even stronger pace of changes, since transition process brought additional challenges in company privatisation. After successful privatisation in dairy processing sector process of restructuring dairy companies was and still is characterised by decreasing number of dairy processing companies followed by increase in average size and internationalisation. Until 2016 two third of dairy processing industry in Serbia come in possession of foreign companies.

Examined inter efficiency of 79 Serbian dairy processing companies in 2016 prove that 18 companies were technically efficient and 30 companies scored pure technical efficiency. Although efficient companies exist in all size groups, average efficiency increasing with increase of groups size. Micro dairies operate on increasing return to scale, while small and middle sized dairies operate on decreasing return to scale conditions. Group of big dairy companies are most efficient.

Comparison of efficiency between dairy processors according ownership revealed that foreign owned dairy companies are more efficient than domestic ones. Among six identified basic strategies practiced by processors in milk supply chain, some strategies proved as better choice. Two big and two middle sized processor oriented on vertical cooperation with dairy farmers reached highest technical efficiency. Slightly lower efficiency is achieved by most numerous groups of dairy processors who specialised only in milk processing without developing strategic relationship with upstream or downstream participants. Group of companies integrated with dairy farm(s) accomplished lowest efficiency results. It was noticed that during period of last decade some dairy processing companies in Serbia were changing relation to upstream and downstream participants in dairy chain searching for more efficient strategies.

Question opened for future research are those oriented on efficiency comparison between Serbian dairy companies and dairy companies in region countries. Another open is question how to decompose output and input variables used to measure technical efficiency on amounts and prices to enable measure of economic efficiency.

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PESTICIDES USE IN AGRICULTURE AND HUMAN HEALTH IN A GLOBAL CONTEXT: EVIDENCE FROM ROMANIA

Raluca Andreea Ion[1]

Abstract

The paper investigates the relation between the pesticides use in agriculture and their effects on human health, in the global context of food security, overpopulation, and climate change. It is assumed that demographic growth led to the need of producing more food for over seven billion people. As the land is limited, the agricultural output must increase intensively, not extensively, meaning that yields are supposed to grow, not the area cultivated. In order to grow the yields, higher amounts of chemical substances, including pesticides, are needed. The objective of this paper is to assess the effects of the pesticides use on human health, using the simple regression model. The main findings show that digestive diseases are correlated to pesticides use. The relevance of the study lies in its capacity to inform people about the effects of the pesticides use on human health, so they could make informed choices on the food they consume.

Key words: *food security, overpopulation, climate change, intensive agriculture, human health, sustainability, resilience.*

Introduction

At the beginning of the twenty-one century, the relationships between food issues and other global emergencies become more complex. Food security is one of the world problems and has connections with other related problems: demographic growth, poverty, energy, natural resources, the environment, world trade and the monetary system, as considered by Bulgaru (2003, p. 21).

Nowadays, the global emergencies are even more complex, in the light of the results of a report in 2016 (Environmental problems): global warming and climate change, pollution, waste disposal, acidification of the oceans, acid rain, ozone depletion, loss of biodiversity and habitat, deforestation, urban expansion, public health, genetic engineering.

1 Raluca Andreea Ion, Ph.D., Associate Professor, Bucharest University of Economic Studies, Department of Agro-food and Environmental Economics, Piata Romana no. 6, Bucharest, Romania, E-mail: raluca.ion@eam.ase

These problems are interdependent. None of these can be addressed separately, as each depends on the others and has consequences for others (Ion, 2017). For example, habitat loss and climate change have a negative impact on biodiversity. In an attempt to solve the food problem in the world, natural resources have been intensively exploited and agricultural practices have had negative consequences on the environment. Demographic growth put pressure on natural resources.

Under this context, food security becomes a challenge in terms of population growth to 9 billion people expected to be the world inhabitants in 2050 (Ion, Popescu, 2013). More food is needed to feed the growing population. Bearing in mind the fact that the agricultural areas are already used and the attempt to include more areas in agricultural system become a problem for the environment, the solution for increasing the agricultural output is to produce food in intensive systems, using chemical substances for higher yields and lower losses. Studies (FAO, 2018, p. 22) estimated that the global yield loss due to biotic stresses (insects, diseases, viruses) averages over 23 percent of the estimated attainable yield across major cereals.

A FAO report (2018) shows that, in developing countries, 80 percent of the necessary production increases needed to feed over 9 billion people in 2050 would come from increases in yields and cropping intensity and only 20 percent from expansion of arable land.

The chemical substances used in agriculture are fertilizers, pesticides and veterinary medicine substances. But chemical substances used in agriculture remain in food as residues and affect human health. Thus, this paper investigates the effects of the chemical substances used in agriculture for obtaining agricultural products on human health.

The research questions are whether there is a relation between chemical substances used in agriculture and human health?, and if yes, what is its direction and intensity?

The objective of the research is to establish the direction and the intensity of the relation between chemical substances used in agriculture and human health. In pursuing this, statistical data for the two variables are analysed with simple regression model, using the SPSS program. The data are retrieved from the National Institute of Statistic in Romania and they refer to the last twenty-two years, from 1995 to 2016.

The paper is structured into six parts. After the introduction, the problem statement is described, based on literature review, with the goal of establishing the research hypothesis, in Section 3. Then, Section 4 presents the methodology, while Section 5 analyses the results of the regression models. Finally, in Section 6, the results are discussed, the hypothesis is validated, and the conclusions are drawn.

Problem statement

We argue that the amounts of chemicals administrated to agricultural crops will rise in the future. On the one hand, overpopulation put pressure on food security and more food is needed to feed 9 million people, expected to be in the perspective of 2050. FAO (2018) reports that food production must increase by 70 percent and the annual cereal production will need to rise to about 3 billion tonnes, from 2.1 billion and annual meat production will need to rise by over 200 million tonnes to reach 470 million tonnes. This increase implies changes in agricultural technology, including pesticides use and land use (Bran, 2012; George, 1997).

On the other hand, global warming leads to abundance of pest, diseases and weeds that will require higher amounts of chemical substances for their management.

There is abundant literature on the relations between global problems: climate change affecting food security and human health, overpopulation and over production putting pressure on natural resources and food security (Gerlach, 2015; Giampietro, Pimentel, 1994; Hoffmann, 2013). McMichael et al. (2003) and Crimmins et al. (2016) sound the negative effects of climate change on human health. Also, a report of The Interagency Working Group on Climate Change and Health (Portier et al., 2010) and other authors (Dich et al., 1997; Borlaug, 2000; Diamond, 2005) outline the effects of climate change on human health: Asthma, respiratory allergies, cancer, cardiovascular disease and stroke, foodborne diseases and nutrition problems caused by food contamination.

This study focuses on the last group of diseases, digestive diseases caused by food contamination. Food can be contaminated by microbial pathogens, parasites, chemical contaminants and bio toxins. Among them, the chemical contaminants coming from the residues of chemical substances administrated to agricultural crops are studied in the paper.

Worldwide, WHO (2017) estimated that 600 million – almost 1 in 10 people – fall ill after eating contaminated food and 420,000 die every year. In Romania, 1,694,876 cases of digestive diseases were reported in 2016 (National Institute of Statistics database, 2018).

Moreover, it is estimated that the quantities of chemical substances will raise, considering the global warming and the need to produce more food for a growing population. It has been demonstrated that climate change may affect agricultural technologies, because the abundance of pests, diseases and weeds will change the type, level and use of chemicals and fertilizers on crops (Miraglia et al., 2009).

These modifications in technologies lead to the need of using higher amounts of chemicals administrated to crops and found, finally, in food products. This is also argued by the WHO report in 2015 (WHO, 2015), showing that the climate of many developing countries favours the proliferation of pests, which need higher amounts of pesticide that is used for their combating.

Research hypothesis

The results of the research described in the previous section drive to the need of answering the questions whether there is a relation between chemical substances used in agriculture, as a result of both climate change and overpopulation needing more food, and human health?, and if yes, what is its direction and intensity?

This paper starts from the hypothesis that global warming, through increasing in number and types of pests, diseases and weeds, and needing, as such, higher amounts of pesticides, has negative impact on human health in Romania. The hypothesis tested in this paper is:

H1: Changes in pesticides use, as effects of climate changes in pests, diseases and weeds, and overpopulation needing more food, may be connected to digestive diseases.

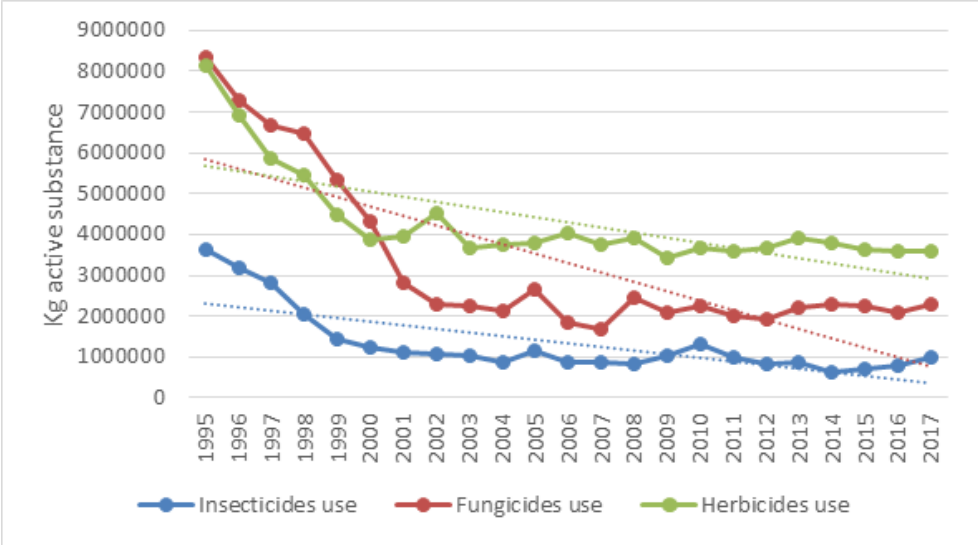
WHO (2015) sustains that contaminated food, containing harmful bacteria, viruses, parasites or chemical substances, causes more than 200 diseases – ranging from diarrhoea to cancers. In this piece of research, digestive diseases are considered for explaining the effects of chemical residues in food to human health.

Research methods

For validating the hypothesis arguing that changes in pesticides use, as effects of climate changes in pests, diseases and weeds, and overpopulation needing more food, may affect human health, the relationships between variables corresponding to the use of pesticides in agriculture and variables corresponding to human health are analysed.

The variables corresponding to the use of pesticides in agriculture are the amounts of insecticides, fungicides and herbicides administrated to crops in Romania, in the period 1995-2017. Figure 1 shows the dynamics of the pesticides use in agriculture. Negative trends can be observed from 1995 to 2003. After 2004, the quantities of insecticides stabilized between 700,000 and 1,000,000 tons of active substance, the quantities of fungicides to 2,000,000 tons of active substance and the quantities of herbicides to 3,500,000 tons of active substance.

Figure 1. *Dynamics of pesticides use in agriculture in Romania, 1995-2017.*

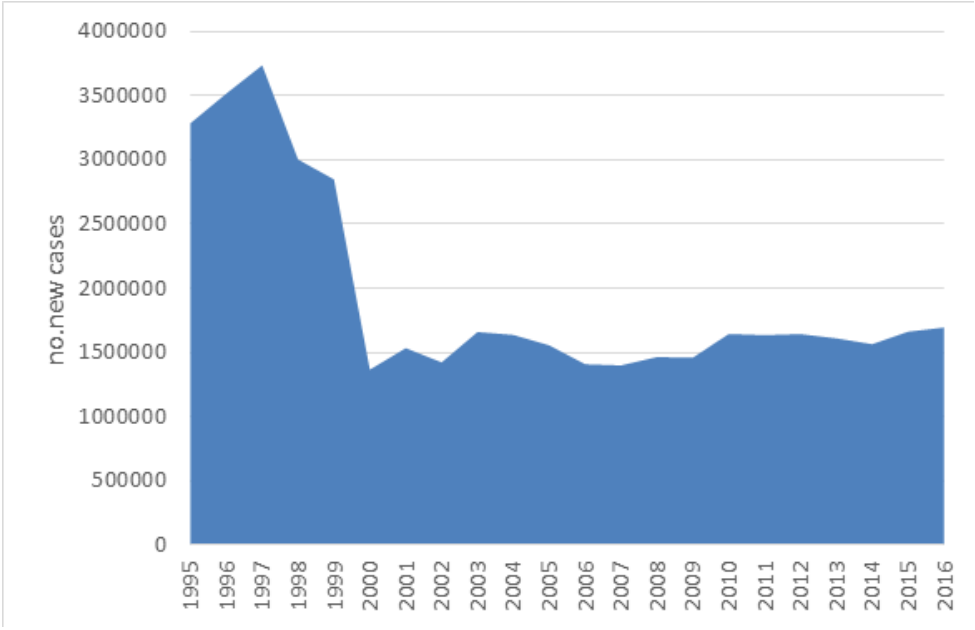


Source: *National Institute of Statistics, Romania.*

The agricultural area in Romania is 12,502,535 hectares (National Institute of Statistics of Romania, 2018). It means that the quantities of pesticides administrated per one hectare are 80 kg of insecticides, 182 kg of fungicides and 285 kg of herbicides.

The variable corresponding to human health is the number of new cases of digestive diseases. Digestive diseases have been chosen because it has been demonstrated that pesticide poisoning may cause nausea, stomach cramps, vomiting, diarrhoea, weakness, headache, confusion, excessive sweating etc. all of them being symptoms of digestive diseases (WHO, 2015). Data on digestive diseases have been retrieved from the National Institute of Statistic of Romania database. They are presented in Figure 2.

Figure 2. *Dynamics of new cases of digestive diseases in Romania, 1995-2016.*



Source: *National Institute of Statistics, Romania*

The number of new cases of digestive diseases dramatically decreased from 1995 to 2000, from 3,286,699 new cases to 1,366,312 new cases. In the period 2000-2016, the number of the new cases of digestive diseases stabilized around 1,500,000 cases per year.

The relationships of dependence between the variables are analysed with SPSS 22, using the simple regression model. The confidence interval is 95%. Twenty-two observations have been introduced, for the period 1995-2016. The source of the data is the National Institute of Statistics of Romania.

Findings

The relation between digestive diseases and insecticides use in agriculture are analysed using the simple regression model. The results are presented in Tables 1 and 2, and Figure 3. The coefficient of correlation between digestive diseases and insecticides use is 0.814, showing a strong and direct relation between the two variables (Table 1).

Table 1. *Correlation coefficients between digestive diseases and insecticides use*

Model	R	R Square	Adjusted R Square
1	.902[a]	.814	.805
a. Predictors: (Constant), Insecticides use b. Dependent Variable: Digestive diseases			

Source: *results of the regression model*

The model which shows the relation between digestive diseases and insecticides use is: y=0.902x, meaning that a change by one unit in the use of pesticides leads to a change with 0.902 in the new cases of digestive diseases.

The values of Sig.is 0.000, below 0.05, meaning that the model is valid. The interval for B value do not contain the value 0, meaning, again, that the model is valid. The results are provided with a standard error of 0.089 (Table 2).

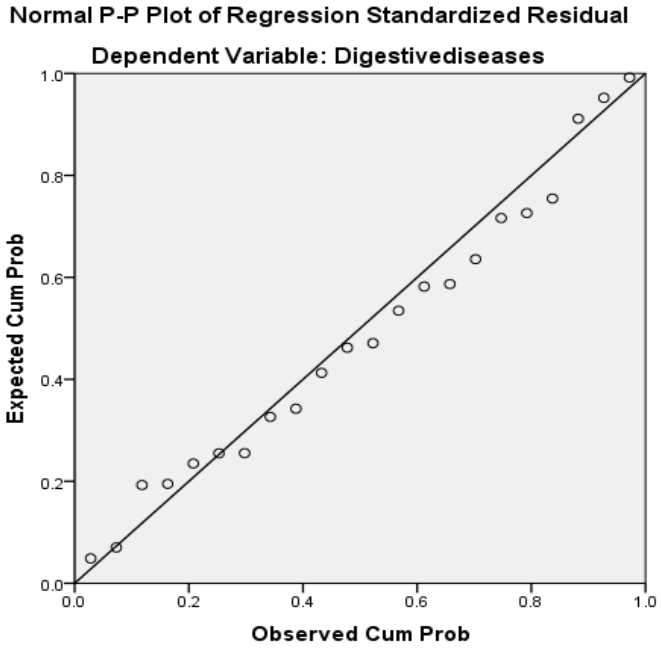
Table 2. *Coefficients of the regression model showing the relation between digestive diseases and insecticides use*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	833976.747	138785.185		6.009	.000	544475.923	1123477.571
	Insecticide use	.831	.089	.902	9.353	.000	.646	1.017
a. Dependent Variable: Digestive diseases								

Source: *results of the regression model*

The graph in Figure 3 expresses the linear correlation between the two variables: digestive diseases and insecticides use.

Figure 3. *The correlation between new cases of digestive diseases and insecticides use*



Source: *results of the regression model*

The relation between digestive diseases and fungicides use in agriculture are analysed using the simple regression model. The results are presented in Table 3 and 4, and Figure 4. The coefficient of correlation between digestive diseases and fungicides use is 0.857, showing a strong and direct relation between the two variables (Table 3).

Table 3. *Correlation coefficients between digestive diseases and fungicides use*

Model	R	R Square	Adjusted R Square
1	.926[a]	.857	.850
a. Predictors: (Constant), Fungicides use b. Dependent Variable: Digestive diseases			

Source: *results of the regression model*

The model which shows the relation between digestive diseases and fungicides use is: y=0.926x, meaning that a change by one unit in the use of fungicides leads to a change with 0.926 of the new cases of digestive diseases.

The values of Sig. is 0.000, below 0.05, meaning that the model is valid. The interval for B value do not contain the value 0, meaning, again, that the model is valid. The results are provided with a standard error of 0.031 (Table 4).

Table 4. *Coefficients of the regression model showing the relation between digestive diseases and fungicides use*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	794018.361	122342.198		6.490	.000	538817.009	1049219.714
	Fungicides use	.344	.031	.926	10.964	.000	.278	.409
a. Dependent Variable: Digestive diseases								

Source: *results of the regression model*

The graph in Figure 4 expresses the linear correlation between the two variables: digestive diseases and fungicides use.

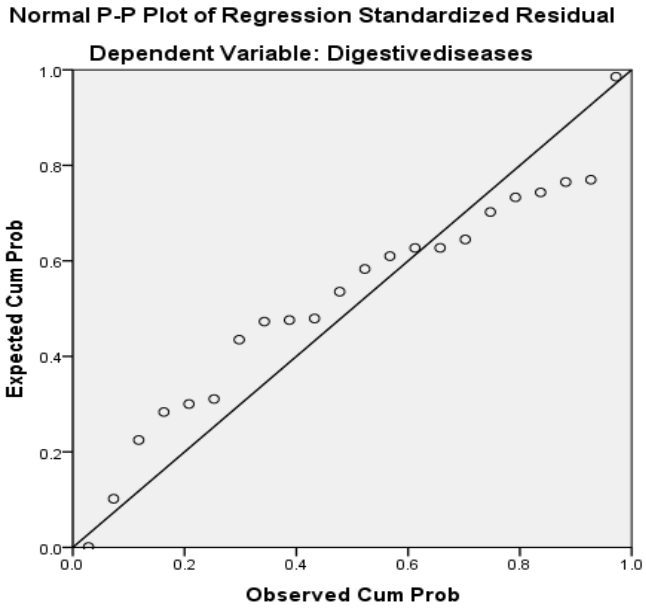
The relation between digestive diseases and herbicides use in agriculture are analysed using the simple regression model. The results are presented in Table 5 and 6, and Figure 6. The coefficient of correlation between digestive diseases and herbicides use is 0.734, showing a strong and direct relation between the two variables (Table 5).

The model which shows the relation between digestive diseases and herbicides use is: y=0.857x, meaning that a change by one unit in the use of herbicides leads to a change with 0.857 of the new cases of digestive diseases.

The values of Sig.is 0.000, below 0.05, meaning that the model is valid. The interval for B value do not contain the value 0, meaning, again, that the model is valid. The results are provided with a standard error of 0.073 (Table 6).

The graph in Figure 5 expresses the linear correlation between the two variables: digestive diseases and herbicides use.

Figure 4. *The correlation between new cases of digestive diseases and fungicides use.*



Source: *results of the regression model*

Table 5. *Correlation coefficients between digestive diseases and herbicides use*

Model	R	R Square	Adjusted R Square
1	.857[a]	.734	.721
a. Predictors: (Constant), Herbicides use b. Dependent Variable: Digestive diseases			

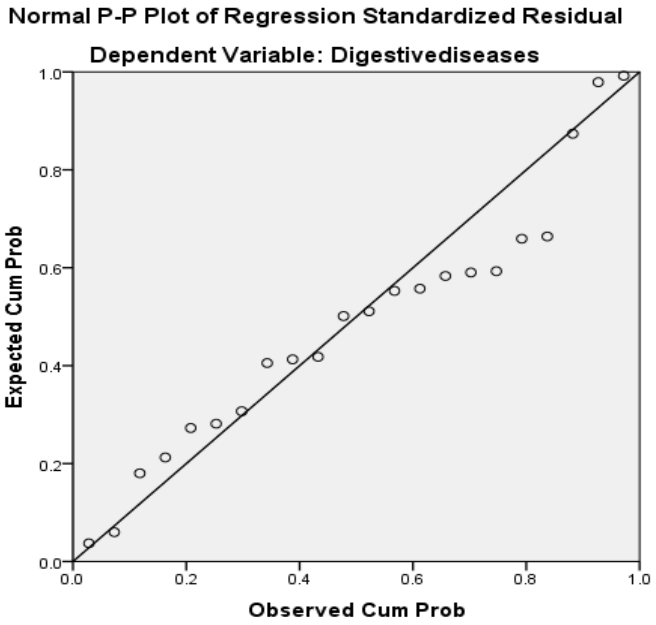
Source: *results of the regression model*

Table 6. *Coefficients of the regression model showing the relation between digestive diseases and herbicides use*

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-408975.023	328223.229		-1.246	.227	-1093636.682	275686.636
	Herbicides use	.542	.073	.857	7.428	.000	.390	.694
a. Dependent Variable: Digestive diseases								

Source: *results of the regression model*

Figure 5. *The correlation between new cases of digestive diseases and herbicides use*



Source: *results of the regression model*

A summary of the models analysed above are presented in Table 7. It shows the direction and intensity of the relations between the variables and the coefficients of the regression functions, under specific standard errors.

Table 7. *The influence of insecticides, fungicides and herbicides use in agriculture on the number of new cases of digestive diseases*

Variable	Coefficients of correlation	Coefficients of regression function	Standard error	Sig.
Insecticides use	.814	.902	.089	.000
Fungicides use	.857	.926	.031	.000
Herbicides use	.734	.857	.073	.000

Source: *results of the regression model*

The research has its limitations. The first limit of the research is that not all digestive diseases are caused by contaminated food intake. There are other causes for digestive problems. We recommend that future research should consider only those cases of digestive diseases caused by food poisoning.

The second limit is the high levels of the values of standard error, especially for the regression model between insecticides use and new cases of digestive diseases (.089), and for the regression model between herbicides use and new cases of digestive diseases (.073). This limits the interpretations of the results.

The third limitation is that, when testing the variables, the value of Skewness test for normality is 1.09, higher than 0.5, but p-value is 0.14, higher than 0.05, meaning that the variables are normal.

The fourth limitation is that not only climate change with its abundance of pests, diseases and weeds, but also agricultural practices are responsible for chemical residues in agro-food products. In their concerns for higher yields and profits, farmers use excessively the fertilizers and pesticides.

In Romania this is even a bigger problem with the agricultural products sold on the producers' market, where the control of chemical substances administrated to crops is difficult to be achieved. Considering the fact that the share of this market in total agricultural output sold on all market is high, the issue of selling unsafe agricultural products is significant.

Conclusions

It was found that pesticides use in agriculture impacts human health. The hypothesis of the research, arguing that: (H1) Changes in pesticide use, as effects of climate changes in pests, diseases and weeds, and overpopulation needing more food, may be connected to digestive diseases, is validated.

The results are similar to those found by WHO (2015) showing that diarrheal diseases are the most common illnesses resulting from the consumption of contaminated food, including chemical contamination, causing 550 million people to fall ill and 230,000 deaths every year. Almost the same results were found by Ebi (et al., 2006), showing that people are vulnerable to climate change, and, as such, to vector-, food-, and water-borne disease.

The research demonstrated that climate change, through intensive use of insecticides, fungicides and herbicides, may have an impact on human health. The same results have been found by Portier (et al., 2006) who sounds, among the climate change effects on human health, foodborne diseases and nutrition problems caused by food contamination. Moreover, the Food Standards Authority

report in 2010 found that the presence of chemicals in food: insecticides, fungicides and herbicides, and veterinary medicine residues, natural, environmental and process chemical contaminants, is a factor affecting food safety.

Under this context, bearing in mind the need to increase the agricultural output by 70 % until 2050, when world population will reach 9 billion people, actions are needed to ensure food security so that every human being has access to adequate food.

First, FAO (2018) estimated that investments in developing country agriculture have to increase by at least 60 percent over current levels. Higher public investment and better incentives for farmers are encouraged.

Another way to increase the agricultural output is to encourage and finance the agricultural research that should focus on finding solutions to increase yields without harming the environment or human health. Pests, diseases and weeds management should be oriented to natural methods and materials, using lower amounts of chemical substances. As such, human being will have access to sufficient, safe and nutritious food, as required to ensure food security.

Acknowledgement

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DYNAMICS OF THE BOVINE PRODUCTS MARKETS IN ROMANIA - MILK AND BEEF

Rodica Chetroiu[1]

Abstract

The paper perform an analysis of the dynamics of Romanian cow's milk and beef market, integrating information on the structure of the bovine breeding sector, domestic cow's milk and beef production, import, export, consumption of milk and beef, production price of milk and beef etc. Regarding the production of cow's milk, we are witnessing a continuous decline after 2014. Also, the cows' number had fluctuations in the studied period, with a tendency to decrease. The milk supply on market increased in 2017 by about 9.9%, compared to 2012 due to the doubling of imports. The beef production was slightly downward during the period 2012-2014, after which it started to increase, reaching in 2016 127.1 thousand tons. In 2017, there was a fall in production of about 3.3% compared to 2016.

Key words: *milk, cows, beef, bovine, offer.*

Introduction

The present paper is intended to be a concrete analysis of the cow's milk and cattle market coordinates in Romania, seen in dynamics, in the context of a difficult period for the bovine livestock sector, both at national and European community level. The market for these two products has a complex economic structure, starting from the level of production farms, of the supply of milk and beef delivered by producers and continuing with the field of imports and exports, in which the defining aspects include the characteristics related to costs, pricing, and profitability issues. These aspects are quantified at all levels of the milk and beef channels, for each economic agent on the chain.

1 Chetroiu Rodica, Ph.D., Scientific researcher III, Research Institute for Agriculture Economy and Rural Development, 61 Mărăsti Blvd., sector 1, Bucharest, Romania, Phone: +40 213 181 686, E-mail: rodica.chetroiu@iceadr.ro

Material and methods

In this paper, fundamental research methods are used, using information from official statistical data sources - FAO, Eurostat, Ministry of Agriculture (MARD). Statistical analysis tools, comparative analysis, graphical tools are used, with Excel software applications. Data analysis is of longitudinal type, being carried out over a certain period of time, having both a quantitative and a qualitative character.

Results and discussions

The structure of the dairy cows sector

The analysis of the data provided by MARD (Table 1) shows that the number of dairy cows farms was on April 30, 2017 of 600,841, with a total of 1,402,862 heads, down from 2016, with 3632 farms.

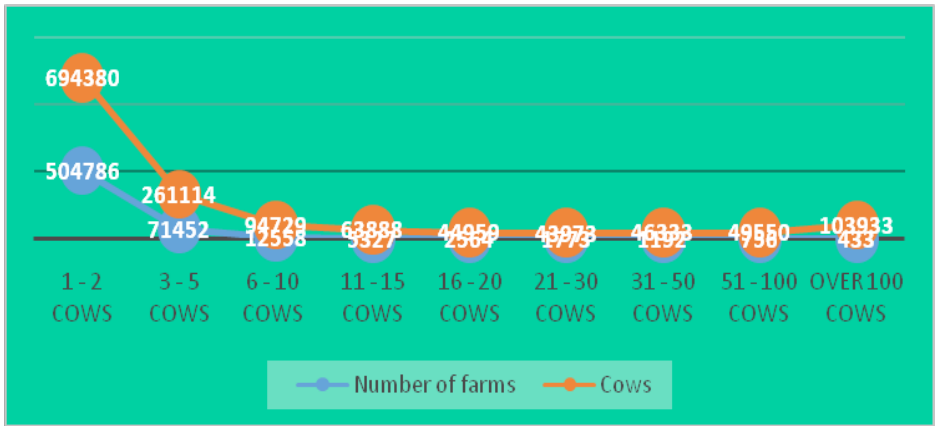
Table 1. *Dimensional structure of dairy and heifer farms - 30 April 2017*

Specification	Total sectors				
	Number of farms	%	Number of cows and heifers	%	Heads on farm
1 - 2 heads	504,786	84.00	694,380	49.50	1.38
3 - 5 heads	71,452	11.89	261,114	18.61	3.65
6 - 10 heads	12,558	2.09	94,729	6.75	7.54
11 - 15 heads	5,327	0.89	63,888	4.55	11.99
16 - 20 heads	2,564	0.43	44,959	3.20	17.53
21 - 30 heads	1,773	0.30	43,973	3.13	24.80
31 - 50 heads	1,192	0.20	46,333	3.30	38.87
51 - 100 heads	756	0.13	49,550	3.53	65.54
over 100 heads	433	0.07	103,933	7.43	240.03
TOTAL	**600,841**	**100.00**	**1,402,862**	**100.00**	**2.33**

Source: *Ministry of Agriculture and Rural Development.*

The largest share belongs to the size class 1-2 heads (84%), followed by the category 3-5 heads (11.9%), the rest of 4.1% representing farms with over 6 heads. The "over 100 heads" size class is a small part of our country's cow's farms, with only 0.072% of total.

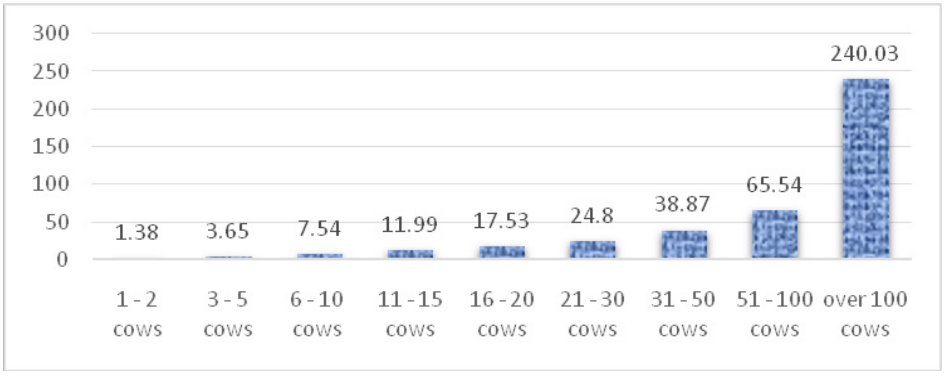
Figure 1. *Dimensional structure of dairy cows and heifers farms*



Source: *Ministry of Agriculture and Rural Development*

The average size of the holdings by size class, illustrated in Figure 2, shows that 84% of the holdings in Romania (size 1-2 heads) have 1.38 heads, being subsistence farms, which makes many of the measures support to not reach the vast majority of them. Also, nearly 92% of the cows' farms do not have legal personality.

Figure 2. *The average size of dairy cows' farms types*

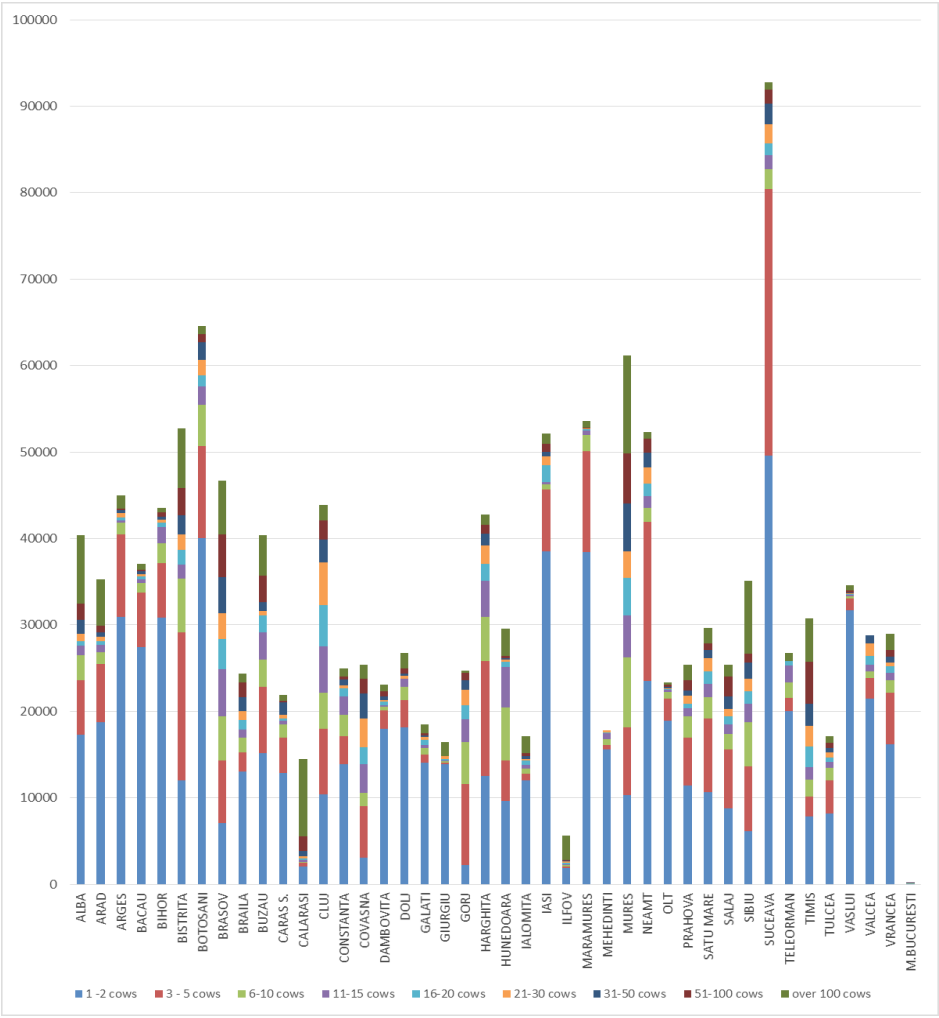


Source: *Ministry of Agriculture and Rural Development*

At territorial level, most farms with cows and heifers are located in the counties of Suceava, Maramures, Botosani, Arges, Iasi. These counties also occupy the first places in terms of flocks. The fewest cows and heifers are in the counties of Ilfov, Călărasi, Gorj, Tulcea, Sibiu, Timis. Distribution of

flocks by size class of farms shows that in almost all counties the size class 1-2 heads prevails (Figure 3).

Figure 3. *Distribution of cows and heifers by size class of farms*



Source: *Ministry of Agriculture and Rural Development*

The structure of the bovine breeding sector for beef

On April 30, 2017, the fattening young cattle population was 333,490 heads, respectively 153,261 holdings. The analysis of dimensional structure of the farms indicates that about 87% of the fattening young cattle holdings belong to

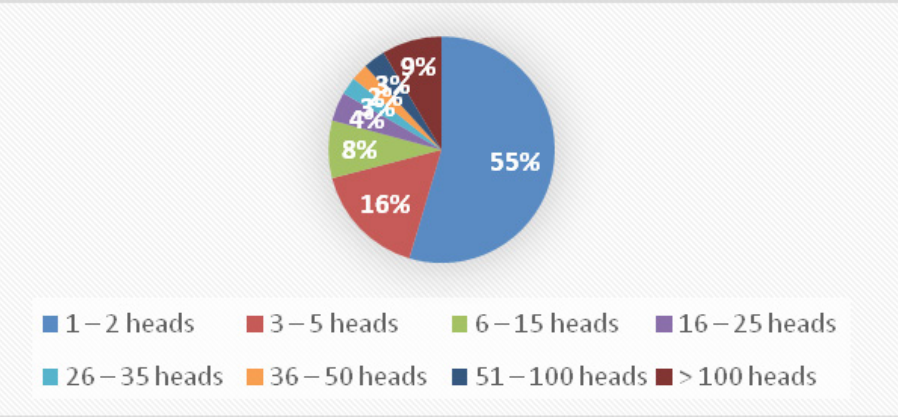
the 1 - 2 - class heads, meaning they belong to the households. Thus, the average size of a young cattle farm in 2017 was 2.18 heads. The farms of category 51-100 heads represented at the end of April 2017 only 0.10% of the total number of young cattle farms, and those with more than 100 heads held only 0.07% of the total number of fattening cattle farms (Table 2).

Table 2. *Dimensional structure of fattening young cattle farms - April 30, 2017*

Specification	Total sectors				
	Number of farms	%	Number of fattening young cattle	%	Heads on farm
1 – 2 heads	133,906	87.37	182,123	54.61	1.36
3 – 5 heads	14,435	9.42	54,501	16.34	3.78
6 – 15 heads	3,154	2.06	27,364	8.21	8.68
16 – 25 heads	967	0.63	13,847	4.15	14.32
26 – 35 heads	320	0.21	8,375	2.51	26.17
36 – 50 heads	221	0.14	8,120	2.43	36.74
51 – 100 heads	150	0.10	10,504	3.15	70.03
> 100 heads	108	0.07	28,656	8.60	265.33
TOTAL	**153,261**	**100**	**333,490**	**100**	**2.18**

Source: *Ministry of Agriculture and Rural Development*

Figure 4. *Structure of the fattening young cattle flocks*

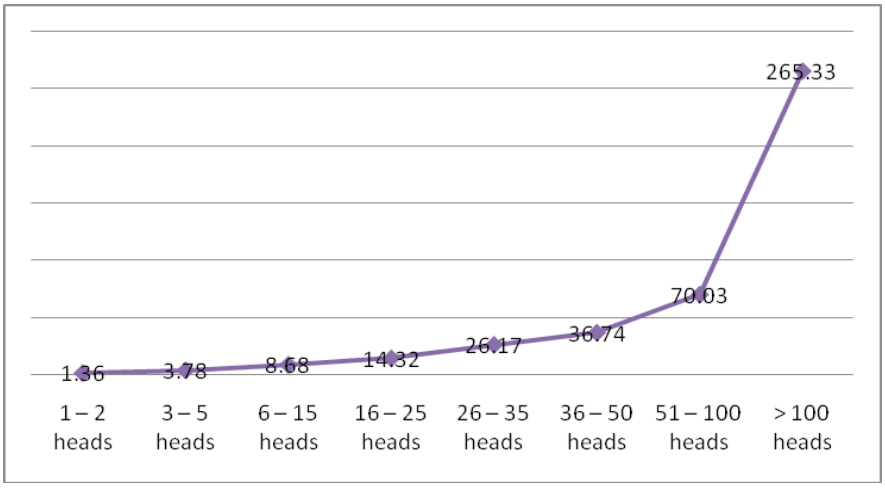


Source: *Ministry of Agriculture and Rural Development*

Regarding fattening young cattle herds, 55% of them are in the households (1-2 caps), 16% in the category 3-5 heads, and in the farms of category over 100 heads, only 9% (Figure 4).

The average size of types of fattening cattle holdings is shown in Figure 5.

Figure 5. *Average size of types of fattening cattle holdings*



Source: *Ministry of Agriculture and Rural Development*

Dynamics of cattle herds by types of property - 2012-2017

According to National Institute of Statistics data, the evolution of cattle herds shows a tendency to increase during the period 2012-2015, and then they decreased by 4% in 2017 as compared to 2015, which is one of consequences of the crisis from 2015-2016, in the milk sector (Table 3, Figure 6).

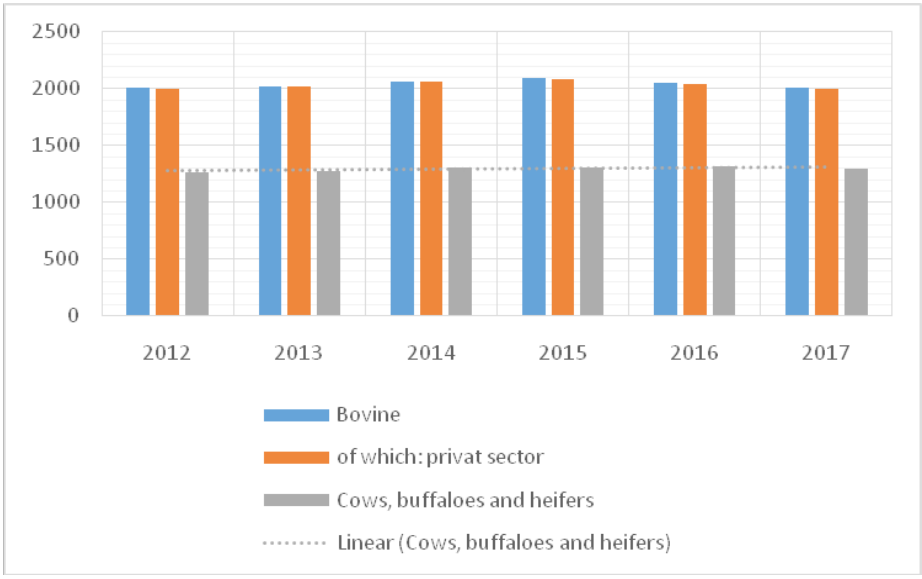
Of the total number of herds, 99.7% belong to the private sector, and 91.8% of them are in individual holdings. The cows and heifers number recorded a slight decrease in 2017 compared to 2016, about 1.5%.

Table 3. *Dynamics of the cattle population - 2012-2017 (thousands of heads)*

Categories	Forms of property	2012	2013	2014	2015	2016	2017
Bovine	Total	2,009	2,022	2,069	2,092	2,050	2,011
	Private sector	2,003	2,016	2,062	2,086	2,043	2,005
	Of which: individual holdings	1,866	1,878	1,915	1,935	1,887	1,840
Cows, buffaloes and heifers	Total	1,265	1,279	1,307	1,311	1,315	1,295
	Private sector	1,262	1,276	1,304	1,308	1,312	1,292
	Of which: individual holdings	1,196	1,211	1,234	1,235	1,236	1,213

Source: *National Institute of Statistics*

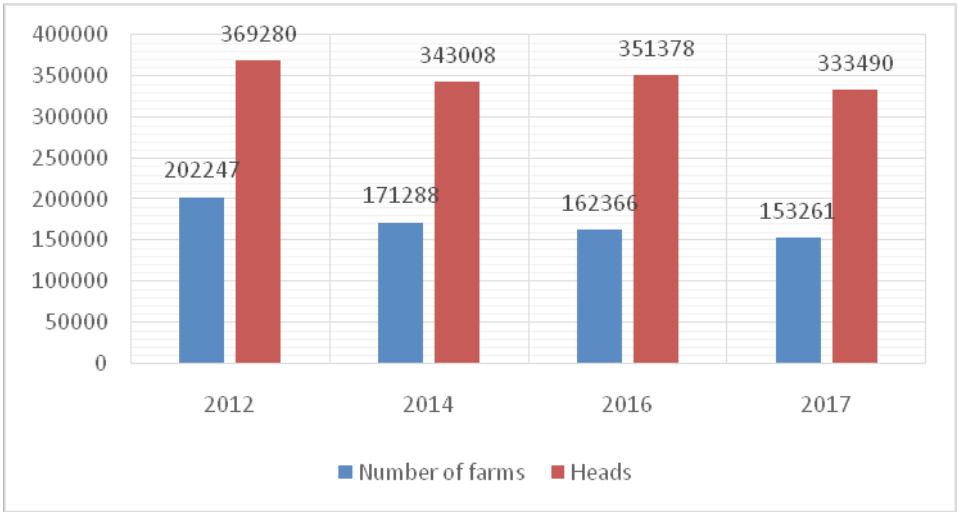
Figure 6. *Bovine herds during 2012-2017 (thousand heads)*



Source: *National Institute of Statistics*

Between 2012 and 2017, fattened young cattle herds have decreased by 10%, from 369,280 heads to 333,490 heads, while the number of holdings in which they are reared fell by 24.3%, from 202,247 in 2012 to 153,261 in 2017 (Figure 7).

Figure 7. *Evolution of herds and number of farms of fattening young cattle*



Source: *Ministry of Agriculture and Rural Development*

In the last years, the numbers of fattening young cattle have fallen on holdings with a size of 1-2 heads and are concentrated on medium-sized farms, as complementary national direct payments are granted from a minimum size of 3 heads / farm.

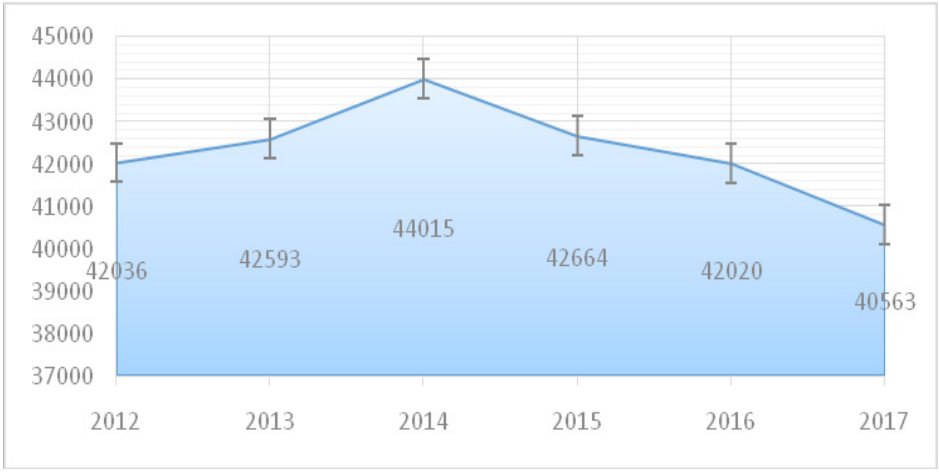
According to data from the Carcass Classification Commission, in the structure of the slaughtered cattle herds, the highest share is represented by cows (48.2 - 64.4%), followed by the fattening young cattle (11.2-27.9%), the rest being heifers, bulls, oxen, young bovine.

Production of cow's milk during 2012-2017

Total production of cow's milk

The domestic production of cow's milk and buffalo milk had an upward trend during the period 2012-2014 (in 2014 there were 44,015 thousand hl), after that it declined continuously, reaching in 2017 at the amount of 40,563 thousand hl, which means a decrease of 3.5% compared to 2012 and almost 8% as compared to 2014 (see Figure 8).

Figure 8. *Dynamics of milk production during 2012-2017 (thousands hl)*

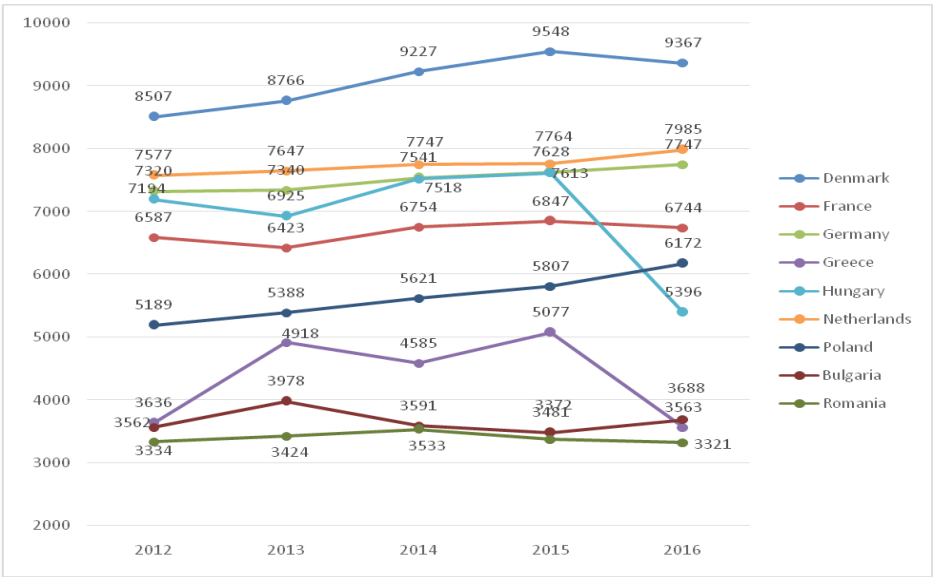


Source: *National Institute of Statistics*

Average milk production in Romania, compared with EU countries

Figure 9 illustrates average milk production in EU countries, indicating that the large milk producing countries are Denmark, which produced 9,367 kg of milk per cow in 2016, Netherlands - with 7,985 kg / cow, Germany - with 7,747 kg / cow.

Figure 9. *Evolution of average milk production during 2012-2016 in Romania and EU countries - kg / cow / year*



Source: *FAOSTAT*

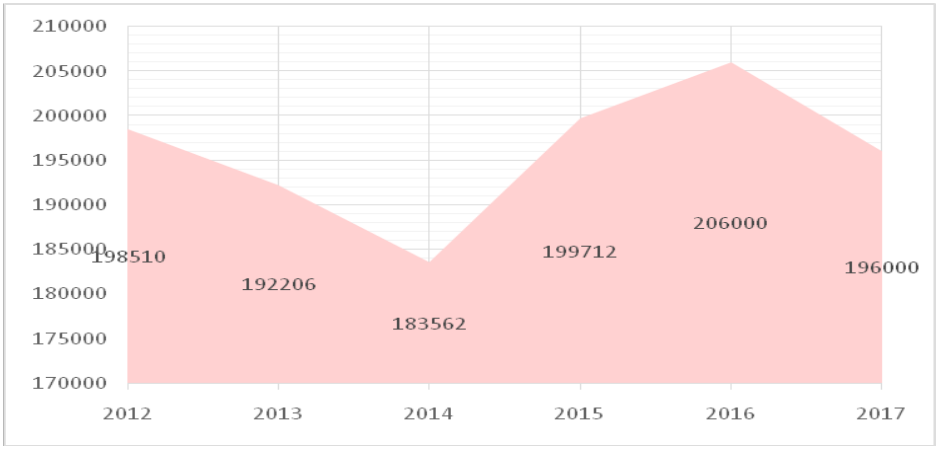
Also, the neighbouring country, Hungary, achieved 5,396 kg of milk per cow in 2016. Romania has among the lowest average milk yields per cow, with 3,321 kg / head in 2016 (FAO data).

But there are dairy farms in Romania that exceed the production of the largest cow milk producers in the EU, but these few examples do not have the power to raise the national indicators, that are influenced in an overwhelming proportion of over 83% of holdings, which have low yields and which determine policies and allocations of factors that disadvantage developed farms.

Domestic production of beef - 2012-2017

The evolution of beef production shows a continuous decrease during 2012-2014, followed by a significant recovery after this period, over 12% in 2016 compared to 2014, and in 2017 it decreased by 10% as compared to 2016 (sees Figure 10).

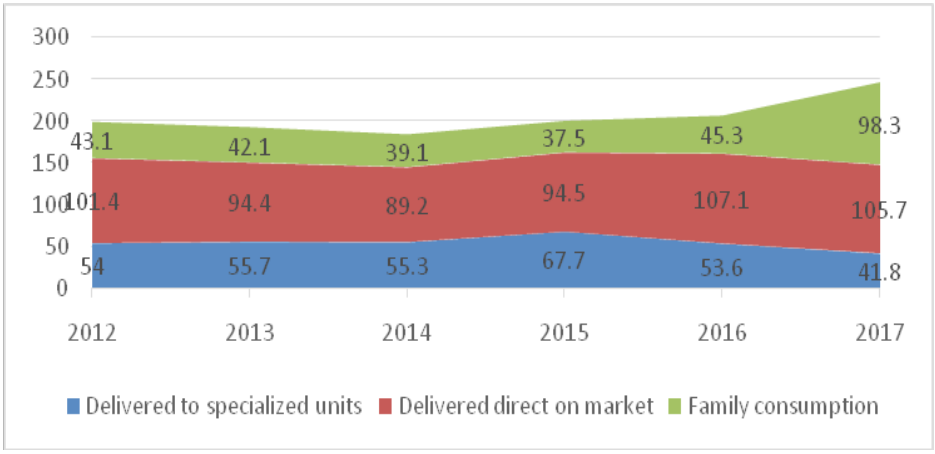
Figure 10. *Dynamics of internal production of beef (tons live weight)*



Source: *National Institute of Statistics*

Regarding the selling of the beef production, 43-52% of it is delivered directly to market, 17-34% is for deliveries to specialized slaughterhouse units, and the family consumption is 19-40% (see Figure 11).

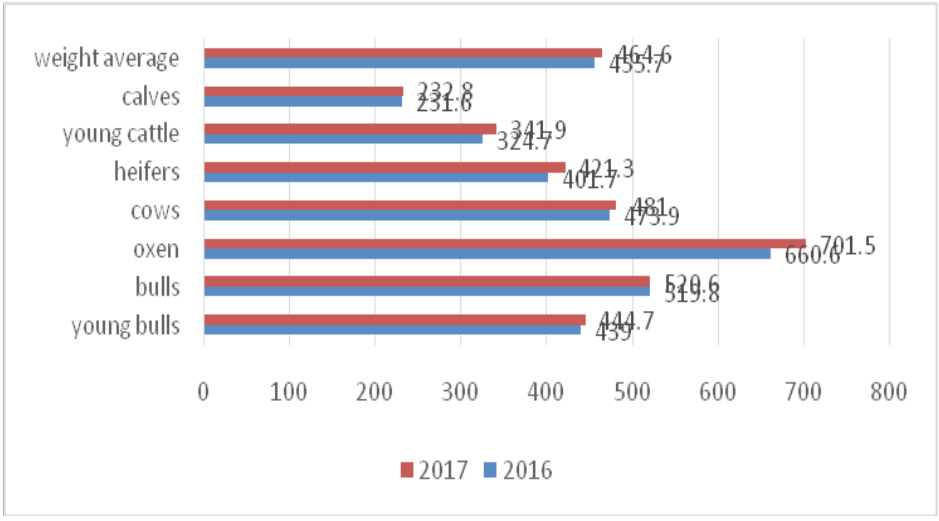
Figure 11. *Utilization of domestic beef production (thousand tons)*



Source: *calculations following NIS, MARD data*

The average live weight at slaughter in 2017 was 464.6 kg / head, the minimum being 232.8 kg / head for calves, and the maximum of 701.5 kg / head for oxen category. The fattened young bulls have a slaughter weight close to average (444.7 kg / head) and bulls of 520.6 kg / head. Reformed cows are sacrificed at a living weight of 481 kg / head (Figure 12).

Figure 12. *Average weight at slaughter by category in the years 2016 and 2017 (live weight / head)*



Source: *Carcass Classification Commission*

Milk demand and supply

During the analysed period, the milk supply on the market increased by about 9.9% in 2017 compared to 2012, due to the doubling of imports, and not on the domestic milk production, which decreased by 2.2%. However, per capita milk consumption increased from 241.1 litres in 2012 to 262.3 litres in 2017 (Table 4, Figure 13).

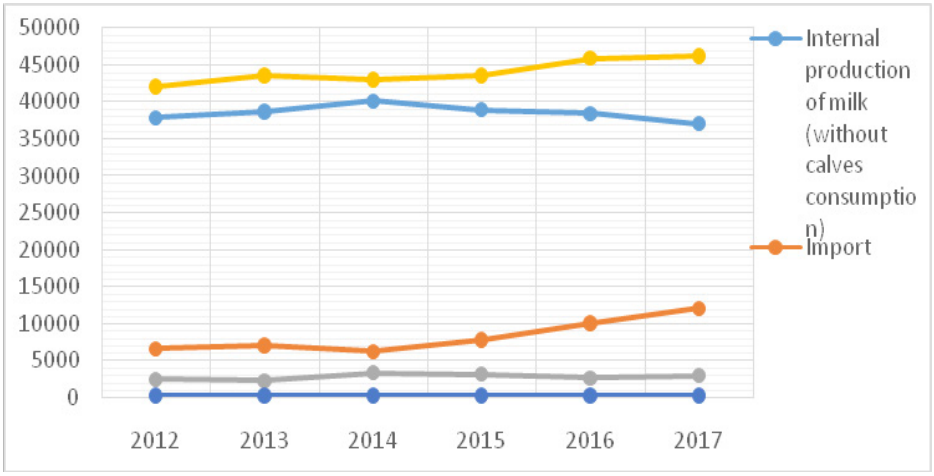
Table 4. *Demand and supply of cow's milk and buffalo milk - thou hl*

Specification	2012	2013	2014	2015	2016	2017
Internal production of milk (without calves consumption)	37,870	38,651	40,096	38,893	38,392	37,030
Import	6,627	7,111	6,278	7,853	10,108	12,073
Export	2,498	2,260	3,361	3,188	2,638	2,953
Milk offer	41,999	43,502	43,013	43,558	45,862	46,150

Specification	2012	2013	2014	2015	2016	2017
Milk consumption – l/capita/year	241.1	244.5	251.5	293.0	230.4	262.3
Share of internal production of milk in offer %	90.2	88.8	93.2	89.3	83.7	80.2

Source: *National Institute of Statistics; Ministry of Agriculture and Rural Development*

Figure 13. *Milk demand and offer – thousand hl*



Source: *National Institute of Statistics; Ministry of Agriculture and Rural Development*

Beef demand and supply

Domestic production of beef had a slight downward trend in 2012-2014, after which it started to increase, reaching 127.1 thousand tons in 2016. In 2017, there was a fall in production of about 3.3% compared to 2016. At the same time, the imports, after a significant increase in 2015-2016, reached 15.5 tons in 2017, 41% less than in 2016, while exports increased by about 25% in 2017 compared to 2016. Under these conditions, the supply of beef fell by about 24% over the period. Of the total supply, imports accounted between 16-24% of the quantity, the remainder being domestic production (Table 5, Graph 14).

Table 5. *Food balance of beef (2012 -2017 period), tons*

Year	Internal production of beef – live weight	Beef (Cut)	Import	Export	Offer	Kg/capita/year	% import of offer
2012	198,510	99,255	12,023	37,638	73,640	5	16
2013	192,000	96,000	13,213	29,972	79,241	5.1	17
2014	183,000	91,500	20,410	25,494	86,416	5.6	24
2015	245,200	122,600	26,793	32,872	116,521	6.3	23
2016	254,200	127,100	26,458	42,792	110,766	6.1	24
2017	245,800	122,900	15,512	53,585	84,827	4.3	18

Source: *NIS, MARD*

Concerning the consumption of beef, it was 6.1 kg / inhabitant in 2016, decreasing in 2017 to 4.3 kg, this being the lowest consumption of beef in the analysed period.

Figure 14. *Food balance – beef (tons)*

Source: *NIS, MARD*

Production cost of milk and producer prices

The economic indicators were estimated both for the level of 3,500 l / cow and for a larger production, of 6,000 l / cow. It is obvious that, in lower production, indicators have lower returns, but at 6,000 l / cow, a return of more than 25% can be achieved (Table 6).

Table 6. *The main economic indicators for milk, RON / litre*

Specification	3500 l/cow	6000 l/cow
A. Production value	1.37	1.38
A1. Of which, main production	1.20	1.20
B. Subsidies	0.11	0.06
D Total expenditures	1.27	1.11
I. Variable expenditures	1.10	0.97
1.Fodder	0.78	0.71
II. Fixed expenditures	0.16	0.15
-Labour costs	0.14	0.11
E. Taxable income	0.10	0.27
Taxes and fees	0.02	0.04
F. NET INCOME + subsidies	0.19	0.29
G.Rate of taxable income (%)	9.26	28.5
H. RATE OF NET INCOME + subsidies (%)	17.56	30.7
Production cost	1.10	0.93
Price	1.20	1.20

Source: *Own calculations*

The milk production cost is 1.10 RON / l at an average production of 3500 l / cap and is reduced to a production of 6000 l / cap, to the value of 0.93 RON / l. Of the cost of milk, feed is the largest expense - 71% for the production of 3500 l and 76% for 6000 l.

Production cost of beef and producers prices

Most of the expenditures included in the production cost of beef are variable costs (about 90%). Within the variable costs, feed costs represent 60.3%, and the biological material introduced to fattening occupy approximately 34.3% (Table 7).

According to data from the National Institute of Statistics, the farm gate price of 2016, which was 5.93 lei / kg live weight, was exceeded in 2017, reaching 6.34 lei / kg live weight.

Table 7. *The main indicators at beef, in 2017*

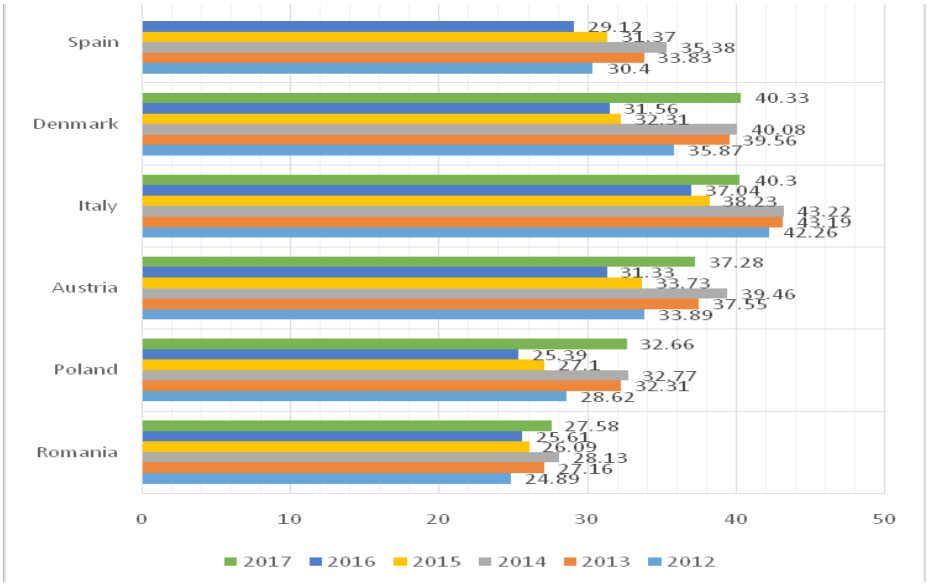
Specification*	RON/kg live weight
I. Variable expenditures	5.30
1.Fodder costs	3.20
2.Biologic material	1.82
II. Fixed costs	0.97
Production costs	5.87
Producer price**	6.34

**Initial live weight 100 kg; average daily gain 1000 g; live weight at delivering 450 kg/head*
***NIS data*
Source: *Own calculations*

Analysis of cow's milk prices on the Romanian market compared to those in the EU

Concerning the producers' milk prices in the EU countries, during the period 2012-2017, it can be seen that it has followed an upward trend until the crisis years 2015-2015, when it dropped, followed by a recovery period in all countries. In Figure 15, among countries surveyed, Romania has the lowest prices, similar to those of Poland, and the highest prices being in Italy and Denmark.

Figure 15. *Producer milk prices in a number of EU countries - Euro / 100 kg*

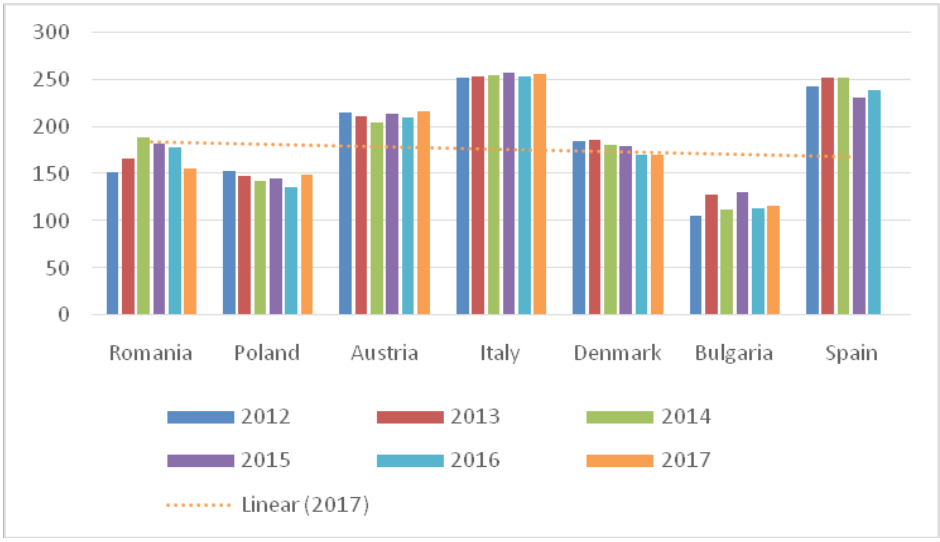


Source: *EUROSTAT*

Production prices for beef in Romania, compared to EU countries

The evolution of live cattle prices between 2012 and 2017 differed from one country to another, varying slightly from one year to the next, according to Figure 16. Thus, Italy and Spain are at the top of the list with the highest prices, Romania averaging 152.52 Euro / 100 kg live weight in 2012 and 155.29 Euro / 100 kg live weight in 2017.

Figure 16. *Evolution of producer prices at beef in European countries (Euro/100 kg live weight)*



Source: *EUROSTAT*

Conclusions

The number of dairy cows in 2017 was of 1,402,862 heads, with the largest share belonging to the size class 1-2 heads (84%). The fattening young cattle population was 333,490 heads and about 87% of the fattening young cattle holdings belong to the 1 - 2 - class heads. Domestic production of cow's milk had an upward trend during the period 2012-2014 after that it declined continuously, reaching in 2017 at the amount of 40,563 thousand hl. Romania has among the lowest average milk yields per cow, with 3,321 kg / head in 2016. The evolution of beef production shows a continuous decrease during 2012-2014, followed by a significant recovery after this period, over 12% in 2016 compared to 2014, and in 2017 it decreased by 10% as compared to 2016. The milk supply on the market increased by about

9.9% in 2017 compared to 2012, due to the doubling of imports, and not on the domestic milk production, which decreased by 2.2%. Domestic production of beef had a slight downward trend in 2012-2014, after which it started to increase, reaching 127.1 thousand tons in 2016. In 2017, there was a fall in production of about 3.3% compared to 2016. Romania has the lowest milk prices among the European countries and the producer price for beef is close to the average of European countries, with 155.29 Euro / 100 kg live weight in 2017.

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THE POSSIBILITY OF THE APPLICATION OF DANUBE AREA GROUNDWATER IN THE IRRIGATION PURPOSES

Sanja Mrazovac Kurilić[1], *Novica Staletović*[2]

Abstract

This paper presents the results of the groundwater quality assessment, on the Serbian Danube water area, for irrigation purposes. The analysis was done at 22 locations on the Danube water area (northern Serbia). The approach to assess the groundwater quality indicators is based on the sustainable water exploitation and the protection of health and environment. This paper presents an overview of the chemical parameters of water samples from the groundwater sources of the Danube water area, ie its shallow aquifer. Indicators on the basis of which the assessment of the possibility of water application for irrigation purposes was done are: electroconductivity, concentration of sodium ions, sodium absorption ratio, residual sodium carbonate, and magnesium hazard and permeability index. Based on the presented indicators, the quality of the shallow aquifer groundwater on the Danube water area for the irrigation purposes can be mostly assessed as satisfactory.

Key words: *groundwater, irrigation, shallow aquifer, Danube water area.*

Introduction

In northern part of Serbia, use of groundwater is the only way of water supply. Groundwater is used, except for drinking purposes, for irrigation purposes.

The quality of water that lies below surface of the Earth depends on the physical and chemical characteristics of the surrounding walls (rocks) in the observed aquifer (Matthess, 1982). The interaction between the water and surrounding rocks is a process that continuously lasts for a very long period of time. Chemical composi-

1 Sanja Mrazovac Kurilić, Ph.D., Associate Professor, Faculty for ecology and environmental protection, University Union-Nikola Tesla, Cara Dušana no. 62-64, 11000 Belgrade, Serbia, Phone: +381 11 21 80 013, E-mail: mrazovac@gmail.com

2 Novica Staletović, Ph.D., Associate Professor, Faculty for ecology and environmental protection, University Union-Nikola Tesla, Cara Dušana no. 62-64, 11000 Belgrade, Serbia, Phone: +381 11 21 80 013, E-mail: nomstale@mts.rs

tion of groundwater is a crucial factor that determines the continued use of water, whether for human consumption, industrial purposes or irrigation in agriculture.

Water used for agricultural irrigation is easily accessible and belongs to the shallow aquifer, which means that it is located at smaller depths, up to 20 m. Water quality for irrigation is determined by laboratory analysis of water samples. The most important factors on the basis of which the possibility of water use in agriculture for irrigation is determined are the following: sodium content; content of carbonates and bicarbonates; pH; salinity; trace elements; toxic anions; nutrients; free chlorine, etc. The intersection of all the above parameter gives a clear picture of the quality of water for irrigation of agricultural land.

The groundwater of the area being analyzed in this paper is widely used for the soil irrigation. The suitability of groundwater for irrigation purposes depends on their mineral (chemical) composition, ie minerals that are components of this water. Water for land irrigation should be of extremely good quality for achieving high productivity of crops in a certain area. Irrigation water contains soluble substances in certain amounts called salts. Salts can contain a certain amount of substances that come from the dissolution of the rock walls between which the groundwater is located.

The electrical conductivity and the content of sodium in water play an extremely important role in the possibility of using groundwater for irrigation. High salt content in irrigation water leads to an increase of osmotic pressure in the soil (Throne, Peterson, 1954), which complicates the root of the plant to extract water. The osmotic pressure is proportional to the salt content of the water or the danger of salinity. Different salts present in irrigation water do not directly affect the growth and development of plants, but also affect the soil structure, permeability and aeration, which also indirectly affect the growth and development of plants (Mohan et al., 2000).

The total content or concentration of dissolved salts in irrigation water can place this water in the zone of low, moderate and high salinity. The high value of water conductivity leads to the formation of salt soil.

Important chemical indicator for determining the benefits of irrigation water are the sodium content or danger of alkalis that is expressed through electrical conductivity, sodium absorption ratio (SAR), sodium % content, and residual

sodium carbonate (RSC), (Robbinson, 1984; Pfeifer et al., 1999; Van de Graaff, Patterson, 2001; Prasad et al., 2001; Bauder et al., 2007; Seilsepour et al., 2009).

Study area

The northern part of the Republic of Serbia, Vojvodina, by largest part of its territory belongs to southeastern part of the great Pannonian basin (Figure 1). The Pannonian Basin is an area extremely rich in groundwater. Total capacity of existing groundwater sources is 197 m^3 per year (Polomčić et al., 2011).

Figure 1. *Map of Europe with position of Serbia and its northern part with Danube course through Serbia*

Source: *own map*

In Figure 2, an overview of the analyzed area with 22 identified localities that belongs to shallow aquifer are shown.

Table 1 shows all localities where the chemical parameters of the shallow aquifer water were determined, together with the coordinates of the mentioned localities and the definition of its water bodies. All analyzed water belong to the shallow aquifer and Danube water area.

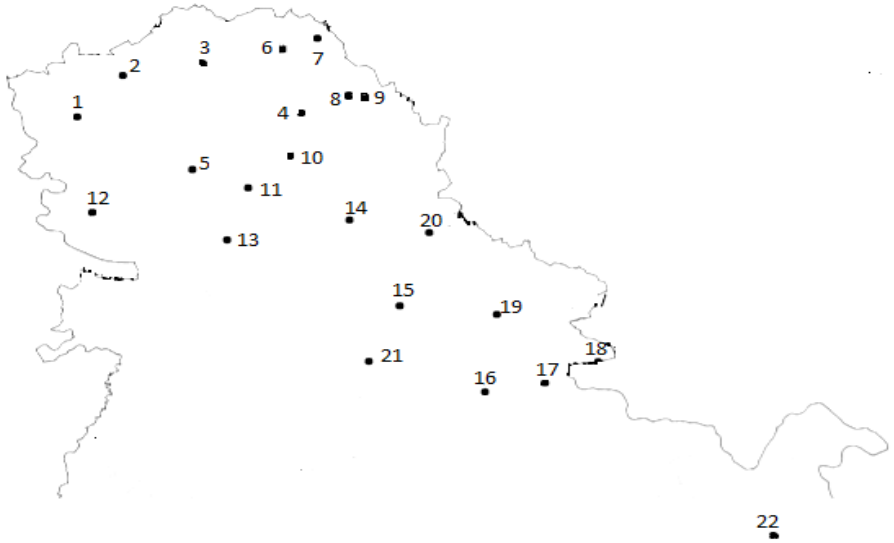
Water bodies are Northwest Bačka, Telečka, Upper Tisa, Northern Banat, Middle Bačka, Lower Tisa, Southwestern Banat, Vršac mountines, Southeastern Banat, Pančevo rit and Negotin-Kladovo aluvion.

Table 1. *Data of 22 localities where the water chemical parameters were determined, with coordinates of localities and their water bodies*

No.	locality	Coordinates		Water body (shallow aquifer)
		N	E	
1	**Sombor**	5070858	7356014	NW Bačka
2	**Aleksa Šantić**	5087933	7372002	Telečka
3	**Subotica**	5096101	7395257	Telečka
4	**Njegoševo**	5070163	7403338	Telečka
5	**Vrbas**	5049187	7396393	Upper Tisa
6	**Kanjiža**	5098500	7427850	Upper Tisa
7	**Banatsko Aranđelovo**	5103110	7440324	Upper Tisa
8	**Kikinda**	5078282	7456747	N Banat
9	**Padej**	5072449	7434668	N Banat
10	**Burza**	5054875	7430650	N Banat
11	**Nadalj**	5041695	7416062	Midd. Bačka
12	**Bač**	5031605	7361298	Midd. Bačka
13	**Novi Sad**	5020359	7408612	Midd. Bačka
14	**Zrenjanin**	5028441	7451606	Lower Tisa
15	**Debeljača**	4993137	7469151	SW Banat
16	**Kovin**	4957745	7499142	SW Banat
17	**Dubovac**	4961434	7520184	SW Banat
18	**Kusić**	4970250	7538800	Vršac mountines
19	**Banatski Karlovac**	4989545	7503331	SE Banat
20	**Sečanj**	5023225	7479525	SE Banat
21	**Borča**	4970273	7458430	Pančevo rit
22	**Negotin**	4900450	7623100	Negotin Kladovo-aluvion

Source: *www.sepa.gov.rs/download/KvalitetVoda2016.pdf*

Figure 2. *Map of study area with marked analyzed localities*



Source: *own map*

Methodology

Electrical conductivity and concentration of Na^+ ions are very important data to know for the classification of water for irrigation. High salt content in irrigation water causes osmotic pressure in soil. In addition, salts directly influence the growth of plants, the structure and permeability of the soil, aeration, texture and make the soil "heavy".

Electrical conductivity (EC) is a measure of the water mineralization degree that depends on the interaction between the water-rock wall, and also of the time that water stay in the rock (Eaton, 1950). The electrical conductivity of water for irrigation becomes one of the most important parameters for estimating the total chemical validity of groundwater and is used to compare water of different areas (Freeze, Cheery, 1979).

Table 2, presents the criteria for assessing the quality of water for irrigation based on the knowledge of the electrical conductivity parameter, or total dissolved solids (TDS).

Table 2. *Criteria for water quality assessment for irrigation on the basis of the electrical conductivity EC value, or ttal dissolved solids TDS value*

TDS (mg/l)	EC (µS/cm)	Quality
<150	<250	Excellent or low C1
150-500	250-750	Good or moderate C2
500-1500	750-2250	Suitable or high C3
1500-3000	2250-5000	Unsuitable or very high C4

Source: *Freeze and Cheery, 1979.*

USSL (United States Salnity Laboratory) from the US Department of Agriculture has adopted several techniques that are used to test the quality of water for agriculture, and some of these are used in this work.

Concentration of sodium ions Na%

This indicator of irrigation water is usually designated by percentual share of Na^+ ion and it can be determined using the formula (Wilcox, 1955):

$$Na\%=(Na^+ + K^+)*100/(Ca^{2+} + Mg^{2+} + Na^+ + K^+)$$

Where the content of individual ions is expressed in meq/l.
Sodium is very important in the classification of irrigation water due to its soil reaction, which causes a decrease in soil permeability.

Sodium in combination with carbonates can lead to the formation of alkaline soils, while in combination with chlorides builds salt soils. The resulting soil types do not contribute to the growth of plants.

Table 3 gives an overview of the criteria for assessing the quality of water for irrigation based on the concentration of sodium ions in water.

Table 3. *Criteria for water quality assessment for irrigation on the basis sodium ion concentration Na% value.*

Na%	Quality
< 20	Excellent 1
20-40	Good 2
40-60	Suitable 3
60-80	Doubtful 4
> 80	Unsuitable 5

Source: *Wilcox, 1955.*

Sodium absorption ratio SAR

SAR is used to make an estimate of the harmfulness that arises from the amount of sodium retained in the soil. Excessive sodium value in water for irrigation of soil leads to undesirable effects such as changes in soil properties, reduction in its permeability and changes in soil structure (Kelly, 1957). Therefore, knowing the concentration of sodium in water is necessary when considering its usefulness for irrigation purposes. USSL recommends estimating the risk of sodium or alkali in irrigation water, which takes into account the relative activity in the Ion exchange reaction with soil expressed in a ratio known as SAR (sodium absorption ratio).

Sodium absorption coefficient is an important parameter for determining possibility of using groundwater for irrigation and is based on determination ratio of the Na^+ ion concentration and the content of Ca^{2+} and Mg^{2+}:

$$SAR=Na^+ / sqrt ((Ca^{2+} Mg^{2+})/2)$$

Where the content of individual ions is expressed in (meq/l).

Table 4, shows the criteria for assessing the quality of irrigation water based on the SAR.

Table 4. *Criteria for water quality assessment for irrigation on the basis of sodium absorption ratio SAR value.*

SAR	Quality
<10	Excellent or low S1
10-18	Good or medium S2
18-26	Suitable or high S3
>26	Unsuitable or very high S4

Source: *Kelly, 1957.*

Residual sodium carbonate RSC

The amount of bicarbonate and carbonate in a higher quantity of soil alkalinity (Ca + Mg) also significantly affects the use of water for irrigation purposes. Residual sodium carbonate (RSC) is often used in assessing the quality of water for irrigation of soil. In order to determine the harmful effect of carbonates and hydrocarbons on the quality of groundwater, the RSC coefficient is calculated by equation (Eaton, 1950):

$$RSC= (CO_3+HCO_3)-(Ca^{2+}+Mg^{2+})$$

Where the content of individual ions is expressed in (meq/l).

Table 5 gives an overview of the criteria for assessing the quality of irrigation water based on carbonate and hydrocarbon content RSC.

Table 5. *Criteria for water quality assessment for irrigation on the basis of residual sodium carbonate RSC value*

RSC	Quality
<1.25	Safe 1
1.25-2.5	Moderate 2
>2.5	Unsuitable 3

Source: *Eaton, 1950.*

Magnesium hazard MH

Generally speaking, calcium and magnesium maintain a state of balance in groundwater. A higher amount of magnesium in water affects the quality of the soil by translating it into alkaline and reducing the yield of crops. Szabolcs and Darab (1964) on this occasion defined the concept of magnesium hazard (MH) for water used in irrigation purposes.

Magnesium hazard (MH) is considered as one of the most important parameters in determining the quality of water for irrigation. The excess of magnesium in water leads to a decrease in plant growth and yield, and an increase in soil salinity. The MH index is calculated according to the equation (Paliwal, 1972):

$$MH= Mg^{2+}x\ 100/(\ Ca^{2+}+Mg^{2+})$$

Where the content of individual ions is expressed in (meq/l).

Groundwater with MH> 50 is considered harmful and inadequate for irrigation.

Table 6 gives an overview of the criteria for assessing the quality of water for irrigation on the basis of magnesium content.

Table 6. *Criteria for water quality assessment for irrigation on the basis vrednosti magnesium hazard value*

MH	Quality
≤50	Good 1
>50	Unsuitable 2

Source: *Szabolcs, Darab, 1964.*

Permeability index PI

The soil permeability is affected by the long-term use of irrigation water and Na, Ca, Mg and HCO_3 content that are in the soil composition. Doneen (1964) has provided a criterion for assessing the possibility of using groundwater for irrigation based on the permeability index PI, which is calculated by the following formula:

$$PI=(Na^+ + sqrt\ (HCO_3^-))*100 / (Ca^{2+} + Mg^{2+} + Na^+)$$

Where the content of individual ions is expressed in (meq/l).

Table 7 provides an overview of the criteria for assessing the quality of water for irrigation on the basis of the soil permeability index. The soil is divided into three classes: excellent, good and unsuitable.

Table 7. *Criteria for water quality assessment for irrigation on the basis of permeability index PI value*

PI %	Quality
>75	Excellent – class I (1)
25-75	Good - class II (2)
<25	Unsuitable - class III (3)

Source: *Doneen, 1964.*

Results and discussion

The results of regular monitoring of the main ions content, electrical conductivity and total mineralization of shallow aquifer water on 22 locations of the Danube water area on the territory of the Republic of Serbia for 2016 are shown in Table 8.

Based on the presented data, basic water quality indicators for irrigation water were calculated: Na%, SAR, RSC, MH and PI.

Based on the calculated values of the indicators, Table 10 shows the value of the individual indicator estimates (including electrical conductivity EC) for a particular location that is monitored. In the last column of Table 10, the aggregate score of all indicators for each locality is given individually.

In order to perform the final assessment of the shallow aquifer water quality, for each of the 22 analyzed localities individually, Table 11 gives a proposal for a division on 3 classes of water according to quality, based on a summary assessment of all indicators: excellent, good and poor water quality for irrigation.

Table 8. *Review of the testing results of groundwater chemical composition on 22 localities of the shallow aquifer, on the Serbian Danube water area, for irrigation purposes. (Ion concentrations of Na^+, Mg^{2+}, Ca^{2+}, K^+, HCO^-, Cl^-, SO_4^{2-} are expressed in meq/l, electroconductivity EC in μS/cm, and total dissolved solids TDS in mg/l)*

No	Na^+	Mg^{2+}	Ca^{2+}	K^+	HCO_3^-	Cl^-	$SO4^{2-}$	EC	TDS
1	7.54	2.42	4.00	0.079	12.67	0.71	0.65	1143	724
2	2.59	2.25	4.55	0.036	8.33	0.62	0.60	790	496
3	2.77	5.08	6.00	0.036	8.75	2.81	2.06	1192	766
4	8.41	4.08	3.75	0.036	11.56	1.73	1.33	1407	895
5	1.59	3.50	4.15	0.033	8.85	0.26	0.42	775	484
6	0.92	1.67	2.55	0.015	6.28	<0.14	0.19	564	348
7	5.60	2.84	6.40	0.026	9.21	5.07	0.69	1349	817
8	5.54	2.58	3.20	0.018	12.21	0.25	0.44	1074	675
9	2.30	3.50	6.80	0.044	10.66	0.91	1.31	1092	696
10	7.42	7.08	6.45	0.051	15.34	3.36	2.29	1832	1125
11	5.12	4.67	4.75	0.046	10.08	0.89	1.67	1269	763
12	1.35	3.33	7.40	0.049	8.52	2.06	1.46	1095	648
13	0.94	10.75	2.85	0.028	9.75	2.00	2.10	1263	745
14	14.27	5.75	7.60	0.018	21.82	1.88	3.04	2330	1488
15	10.94	2.92	1.30	0.013	12.08	1.10	1.96	1310	829
16	0.96	1.75	4.10	0.026	6.46	<0.14	0.17	589	363
17	0.29	1.50	3.50	0.013	4.64	<0.14	0.52	463	288
18	0.30	0.50	4.15	0.113	4.18	0.17	0.48	461	271

No	Na^+	Mg^{2+}	Ca^{2+}	K^+	HCO_3^-	Cl^-	$SO4^{2-}$	EC	TDS
19	14.2	2.58	2.90	0.028	6.18	0.17	0.10	568	351
20	84.83	1.58	1.85	0.021	8.95	3.21	0.10	1140	663
21	21.61	4.17	6.55	0.074	8.85	1.96	0.75	1065	630
22	1.08	3.08	8.35	0.149	8.90	1.40	2.04	1028	616

Source: *www.sepa.gov.rs/download/KvalitetVoda2016.pdf and own calculation*

After the analysis, it can be noticed that a total of 12 localities, out of 22, possess excellent water quality for irrigation originating from the shallow aquifer, where the lowest achieved is the aggregate score of 8, at sites 16,

Table 9. *Review of the results of calculated irrigation water quality indicators for 22 localities on the Serbian Danube water area*

No	Na%	SAR	RSC	MH	PI
1	54.27	4.21	6.25	37.70	79.51
2	27.86	1.41	1.53	33.09	58.32
3	20.21	1.18	-2.33	45.85	41.36
4	51.89	4.25	3.73	52.11	72.72
5	17.50	0.81	1.2	45.75	49.40
6	18.14	0.63	2.06	39.57	66.65
7	37.84	2.61	-0.03	30.74	58.19
8	49.02	3.26	6.43	44.64	79.81
9	18.54	1.01	0.36	33.98	44.17
10	35.57	2.85	1.81	52.33	54.11
11	35.42	2.36	0.66	49.58	57.05
12	11.53	0.58	-2.21	31.03	35.34
13	6.64	0.78	-3.85	79.04	27.94
14	51.70	5.52	8.47	43.07	68.58
15	72.19	0.06	7.86	69.19	95.09
16	14.42	0.56	0.61	29.92	51.42
17	5.71	0.18	-0.36	30.00	46.20
18	8.16	0.20	-0.47	10.75	47.36
19	72.19	8.58	0.7	47.08	84.79
20	96.12	64.78	5.52	46.06	99.50
21	66.92	9.33	-1.87	38.90	76.04
22	9.71	0.45	-2.53	26.95	32.48

Source: *own calculation*

The 17 and 18-area of Banat iandVršac mountine. 9 of 22 localities show the average water quality for irrigation, while only one site is estimated as unsuitable, the site number 20- Sečanj in Banat. In percentage terms, 96% of the shallow aquifer water at 22 localities of the Danube water area in the Republic of Serbia can be safely used for irrigation purposes.

Water quality indicators for irrigation water are shown in Table 9 and are calculated by the content of the ions expressed in meq/l.

The estimates of individual indicators are expressed as dimensionless, and in this way it is possible to express the final summary of each individual locality.

Table 10. *Review of the shallow aquifer water quality indicators assessment for irrigation purposes, on 22 localities of Serbian Danube water area*

No	Na%	EC	SAR	RSC	MH	PI	SUM
1	3	3	1	3	1	1	12
2	2	3	1	2	1	2	11
3	2	3	1	1	1	2	10
4	3	3	1	3	2	2	14
5	1	3	1	1	1	2	9
6	1	2	1	2	1	2	9
7	2	3	1	1	1	2	10
8	3	3	1	3	1	1	12
9	1	3	1	1	1	2	9
10	2	3	1	2	2	2	12
11	2	3	1	1	1	2	10
12	1	3	1	1	1	2	9
13	1	3	1	1	2	2	10
14	3	3	1	3	1	2	13
15	4	3	1	3	2	1	14
16	1	2	1	1	1	2	**8**
17	1	2	1	1	1	2	**8**
18	1	2	1	1	1	2	**8**
19	4	2	2	1	1	1	11
20	5	3	4	3	1	1	**17**
21	4	3	2	1	1	1	12
22	1	3	1	1	1	2	9

Source: *own calculation*

Based on data presented in Table 10, it can be concluded that shallow aquifer of Danube water area on territory of Serbia possesses excellent and good quality water suitable for irrigation, and this is compatible with fact that northern part of Serbia is largest area of fertile land on the territory of Serbia.

Table 11. *Review of the criteria for the final assessment of the shallow aquifer water quality for the irrigation purposes, on 22 sites of the Serbian Danube water area*

SUM	Quality
6-10	Excellent
11-16	Good
17-21	Poor

Source: *own calculation*

Conclusion

In this paper the systematization of the shallow aquifer water quality in Danube water area on the territory of the Republic of Serbia for the purpose of soil irrigation was performed The analysis was done on the basis of regular monitoring data on 22 monitoring stations in the Danube water area. The measured parameters that were taken into consideration are electrical conductivity (EC), total dissolved solids (TDS), as well as ions content of sodium, magnesium, potassium, calcium, hydrocarbonate, chlorine and sulphate.

Based on the measured values, water quality indicators for irrigation water were also assessed: Na%, SAR, RSC, MH and PI, and based on the value of these parameters, an assessment of each individual site was given. It can be concluded that 41% of the analyzed localities show good shallow aquifer water quality for irrigation, 55% excellent quality, while only 1 locality (Sečanj) or 4% of the total number of localities has insuitable water quality for irrigation.

Based on analyzed data, the overall water quality of the shallow aquifer in Danube water area on the territory of the Republic of Serbia is exceptionally satisfactory.

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THE IMPACT OF HUMAN RESOURCES IN HOTELS ON THE COMPETITIVENESS AND SUSTAINABILITY OF DONJE PODUNAVLJE AS TOURISM DESTINATION

Snežana Milićević[1], Jelena Petrović[2]

Abstract

Hotels as the important part of tourism industry represents labour-intensive sector. The purpose of this paper is to indicate the most important human resources to achieve competition and sustainability of Donje Podunavlje as tourism destination. The study relies on comparative analysis, correlation analysis, and regression analysis. Based on model of Ritchie and Crouch and model of Dwyer and Kim, the survey was made with aim to analyse the competitiveness of Donje Podunavlje as tourism destination. The paper comprises the following segments: a) analysing the competitiveness of Donje Podunavlje as tourism destination; b) analysing the economic aspects of sustainability of Donje Podunavlje as tourism destination; c) testing correlation between the competitiveness and sustainability of observed destination; b) analysing the impact of human resources in hotels on tourism competition of Donje Podunavlje.

Key words: *human resources, hotels, competiveness, sustainability, tourism destination, Donje Podunavlje.*

Introduction

Donje Podunavlje is tourism destination with the high concentration natural and antropogenical tourism resources with different degree of protection, sustainability and valorisation. This destination has the rich cultural and historical heritage that can be base for the tourism development. But, it is necessary to indicate the existence of barriers to the tourism development. First of all, it refers to the poor connection of the destination with the other parts of country as well as to the

1 Snežana Milićević, Ph.D., Associate Professor, University of Kragujevac, Faculty of Hotel Management and Tourism in Vrnjačka Banja, Vojvođanska street no. 5A, 36210 Vrnjačka Banja, Serbia, Phone: +381 36 515 00 24, E-mail: snezana.milicevic@kg.ac.rs

2 Jelena Petrović, Ph.D., Associate Professor, University of Niš, Faculty of Science and Mathematics, Department of Geography, Višegradska street no. 33, 18000 Niš, Serbia, Phone: +381 18 533 015, E-mail: jelena25@pmf.ni.ac.rs

transit traffic, which is done through the National Park. From the economic point of view, disadvantages are: low level of economic development, high unemployment, depopulation and unfavourable structure of the population.

The tourism destination Donje Podunavlje includes the following five municipalities of Eastern Serbia: Veliko Gradište, Golubac, Majdanpek, Kladovo and Negotin. In the paper, special attention will be dedicated to the analysis of the tourist offer and tourism demand of each municipality, ie analysis of natural and anthropogenic tourist potentials and analysis of accommodation capacities as well as tourist traffic.

Starting from the tourist traffic, the analysis of the economic aspects of tourism sustainability will be carried out, with special attention being paid to the analysis of Average length of stay of tourists in observed destinations, ie in Veliko Gradište, Golubac, Majdanpek, Kladovo and Negotin. The Average lenght of stay of tourists represents one of indicator of Economic Value Core Indicators. The system of indicators of tourism destionation sustainable development proposed by the European Commision (European Commision, 2013) includes the following sets of indicators: Destinations Management, Economic Value, Social and Cultural Impact and Environmental Impact. All these sets of indicators can be divided into the Core and Optional Indicators. The Economic Value Core Indicators include the following indicators: Number of tourist nights per month, Average length of stay of tourists (nights), Occupancy rate in accommodation (average for the year), and Direct tourism employment as percentage of total employment, Percentage of tourism enterprises inspected for fire safety in the last year and Percentage of tourism enterprises actively taking steps to source local, sustainable and fair trade goods and services. Based on the results of the questionnaire, the analysis of the competitiveness of the observed destinations and the impact of human resources in hotels on destination competitiveness will be carried out. At the same time, special attention will be dedicated to the analysis of the interdependence between the sustainability and competitiveness of the observed destinations.

Literature review

The main objective of each tourism destination is to achieve long-term competitive advantage on the tourism market (Ritchie, Crouch, 2000). The competitiveness of tourism destinations is linked to their capability to deliver tourist experiences that bring greater satisfaction to tourists compared to competitive

destinations (Vengesayi, 2003). New experiences become a main motive for a decision on tourism travel (Milićević, Petrović, 2017). In other words, to be competitive, tourism destination has to offer to the tourism market a greater value than its competitors (Petrović, Milićević, 2015). According to Buhalis (2000), destinations are amalgams of tourism products and services, offering an integrated experience to consumers. However, to be competitive, a destination's tourism development must be economically, ecologically, socially, culturally and politically sustainable (Ritchie, Crouch, 2000).

There are several models of tourism destination competitiveness: Ritchie and Crouch (1993, 2000, 2003), De Keyser and Vanhove (1994), Chon and Mayer (1995), Hassan (2000), Heath (2002), Dwyer and Kim (2003), Gooroochurn and Sugiyarto (2005), etc. Certainly, in the literature special attention was paid to the Crouch and Ritchie (1993, 2000, 2003) Conceptual model of destination competitiveness, Integrated model of destination competitiveness by Dwyer and Kim (2003), and Model for measuring the competitiveness of tourism destinations that was developed by the World Economic Forum (WEF) (Petrović, Milićević, 2015).

Crouch and Ritchie Conceptual model of destination competitiveness comprises five main groups of factors: Supporting Factors and Resources; Core Resources and Attractors; Destination Management; Destination Policy, Planning and Development; and Qualifying and Amplifying Determinants. Each of these groups contains different attributes of destination competitiveness. In total, the model identifies 36 destination competitiveness attributes (Crouch, 2011).

Integrated model of destination competitiveness by Dwyer and Kim comprises six main groups of factors: Endowed Resources; Created Resources (the Resources category is divided into two types: Endowed and Created); Supporting Resources; Situational Conditions; Destination Management; Demand Conditions (Dwyer, Kim, 2003). This model explicitly recognises demand conditions as an important determinant of destination competitiveness (Petrović et al., 2017).

For the purpose of determining and comparing the competitiveness of the countries as tourism destinations, the WEF made the Travel & Tourism Competitiveness Index (TTCI). The TTCI measures four broad factors of competitiveness. These factors are organized into sub-indexes (Enabling Environment; T&T Policy and Enabling Conditions; Infrastructure; Natural and Cultural Resources),

which are further divided into 14 pillars. The aim of the TTCI, which covers 136 economies in 2017, is to provide a comprehensive strategic tool for measuring the set of factors and policies that enable the sustainable development of the travel & tourism sector, which in turn, contributes to the development and competitiveness of a country (WEF, The Travel & Tourism Competitiveness Report 2017).

Based on model of Crouch and Ritchie (1993, 2000, and 2003) and model of Dwyer and Kim (2003), the questionnaire was made with aim to quantify and analyse the competitiveness of Donje Podunavlje as tourism destination.

Hotels and other subjects in tourism „tend to be labour intensive" (Hayes, Ninemeier, 2009:5) because only employees can provide the service quality that tourists and quests expect. Employees and their continuously education, development and training represent important factors of achieving and maintaining the competitiveness in tourism (Bakić, 2002). „Request for better-qualified human resources is a key requirement for improving the destination competitiveness" (Janković Milić et al., 2011:444). Although, „the human resources are the source of competitiveness" (Bulatović et al., 2016:145), insufficient attention is paid to human resources as a factor of destination competitiveness in the literature.

The hypotheses to be tested in this study are the following:

H1: There is correlation between the average length of stay of tourists and the destination competitiveness;

H2: There is the statistical significant impact of human resources in hotels on destination competitiveness.

Bearing in mind that the average length of stay of tourists records the decrease in all municipalities of Donje Podunavlje in period from 2000 to 2016 in the paper special attention is paid to the analysis the independence between the average length of stay of tourists and tourism competitiveness. The paper examines whether increasing competitiveness of observed destination would contribute to the average length of stay of tourists. Because the human resources represent source of competitiveness (Bulatović et al., 2016:145), in the paper special attention is paid the analysis the influence the human resources in hotels to the destination competitiveness.

Analysis of tourist offer of Donje Podunavlje

The Municipality of Veliko Gradište is located at the foothill of the Carpathians and Homolje Mountains, at the confluence of Pek in the Danube. It represents the "vestibule" of Đerdap and one of a large port on the Danube. Đerdap covers an area of 64,000 ha and it is located on the right bank of the Danube from Golubac to Karataš (near Kladovo) (Nešković, Savić, 2018).

The important elements of natural heritage of Veliko Gradište are: Danube River, Srebrno Lake, Gorica Hill, Labudovo Okno and Ada Čibuklija. The important elements of cultural heritage are: the old city charm, the Ram fortress, the Roman military fortress Lederata, the Roman city Pinkum and the sacred objects - the monastery Nimnik and the church of St. Anarchist Gavrilo.

Veliko Gradište has a share of 17,74% in total beds of Donje Podunavlje. The structure of accommodation consist three hotels, five apartments and nine villas (Tourism Organization Veliko Gradište).

The Golubac is located in the north-eastern part of Serbia and belongs to the Braničevo district. The Golubačka gorge is the most well-known geomorphological form in the Golubac and the first narrowing point on the Danube in the Đerdap gorge.

After the Golubac Gorge, the Danube River enters in the Ljubovska valley (12km) that excels in large area. The sides of the valley reach the height of 150m. Downstream the Ljubovska valley a short Gospođin vir gorge appears, with steep slopes, which reach the height of 550m featuring colossally above the Danube" (Stanković, 2002:39).The most important elements of cultural heritage in Golubacare: the medieval fortress Golubac, the Golubac town, the Čezava, the monastery Tuman, the church of St. Nikola and ethno museum.

Golubac has share a share 8,17% in total number of beds in Donje Podunavlje. It records the lowest share in the relation to the other municipalities of Donje Podunavlje. The accommodation capacities in Golubac consist of one hotel, one villa, five apartments and three guesthouses (Tourism Organization Golubac).

The municipality of Majdanpek is located in northeast Serbia along the Danube. It covers the southern parts of the hilly and mountainous area of the Carpathi-

an wreath. The territory of Majdanpek is predominantly mountainous, where the most significant forms of mountain relief are: Miroč, Šomrda, Deli Jovan, Veliki krš, Mali krš, and the mountain Starica. In the territory of the Majdanpek stand out: the Đerdapska gorge, canyon Boltinjska Reka, the Gradašnica, the Rajkov cave, the cave Gradašnica on the slopes of Miroča (one of the deepest caves in Serbia), lake Veliki Zaton, lake of Kazan stream, Danilov vrelo, river Pek, Porečka river and Beli izvor. Biogeographical values are most represented in the zone of National Park "Đerdap". It is divided into the three zones of protection. The first zone represents „the strict protection of natural and cultural heritage" (Macura et al., 2013:369). The second zone covers the area surrounding the first zone, while the third zone covers the area surrounding the first and second zone. In third zone is permitted the following activities: „tourism, sports, forestry, water use, potential exploitation of mineral resources, urban construction and development (Macura et al., 2013:369)."„Well-preserved eco-systems and landscape diversity provide possibilities for developing different forms of special interest tourism, as well as different types of sporting activities" (Popović et al., 2012:49).

The Djerdap gorge on the territory of Majdanpek is considered to be the most beautiful valley of the Danube because it includes the Donji Milanovac valley and Veliki Kazan canyon. Veliki Kazan (12 km) excels with its rocky sides that reach height of 300m (Stanković, 2002:39).

„Miroč Mountain, Veliki and Mali Srbac, the Danube River, the Djerdap Gorge, Veliki and Mali Kazan are the real place of world permeation both on land and in the water" (Valjarević et al., 2015:99). Mountain Miroč is located in the Djerdap National Park and it is surrounded by the Danube from all the sides. The highest peak of Miroc is Veliki Strbac, while Mali Strbac is the second highest peak.

The most important elements of cultural heritage in Majdanpek are the following: the archaeological locality "Lepenski vir", the archaeological locality "Stara Topionica", the locality "Okno", the ski centre "Rajkovo", the Tenkina house, the church of Sv. Nikola and Church of St. Apostles Peter and Paul. The significant events attracted by tourists are "Women painters", "Village sports Olympiad", exhibitions "Majdan art" and many others.

Majdanpek has share a share 24,47% in total number of beds in Donje Podunavlje. It records the second place in the relation to the other municipalities of Donje Podunavlje. Its accommodation structure is consisting by two hotels and one guesthouse (Tourism Organization Majdanpek).

The cultural and historical monuments and archaeological sites in Majdanpek are Trajan′s Bridge, Trajan′s Table, Fetislam Fortress, Roman settlement - "Egeta", Haiduk′s Mill and Etnopark, Archaeological museum "Djerdap".

Kladovo is located in the north-eastern part of Serbia, at the foothill of mountain Miroč in the Ključ area. The most important natural resources of Kladovo are Dunav and Djerdap gorge. The most attractive part of the Đerdap gorge in the territory of Kladovo is Veliki and Mali Kazan canyons. Mali Kazan represents the narrowest part of the Djerdap gorge, with only 180m wide (Stanković, 2002:39). Riparian area of Mali and Veliki Kazan is more difficult accessed by road than by the waterway (Stanković, 2002:39).

Kladovo has a dominant share with 37.98 % in total number of beds in Donje Podunavlje. Two hotels, ten apartments and two guesthouses are located in Kladovo (Tourism Organization Kladovo).

Negotin is located in eastern Serbia on the border of the Republic of Serbia, the Republic of Bulgaria and the Federal Republic of Romania. It extends between the Danube and Timok flows to the north and east and the mountain Deli Jovan and the Great Reef on the west.

The most important elements of natural heritage in Negotin are: mountains (Deli Jovan and Veliki Greben), rivers (Vratna, Zamna, Dunav and Timok), caves (Resava cave and Duduć cave) and nature reserve "Bukovo".The centre of the Negotin is a protected cultural heritage. It includes the birthplace of Stevan Mokranjac, the museum of Haiduk Veljko with a gallery and the building of the Pedagogical Academy from the XIX century.

"Negotinske pivnice" represent an ethnological complex of wine cellars, built in the late XVIII and early XIX centuries in the village of Rajac, Rogljevo, Smedovac and Štubik. They were built in the period when Negotin was known for wine export to France, Germany, Austria and Russia.

Negotin has a share with 11.63 % in total number of beds in Donje Podunavlje. The accommodation services are provided by one hotel, one hostel, three villas and three lodgings (Tourism Organization Negotin).

The observed destinations have favourable natural and cultural heritages for the tourism development. At the same time, it is necessary to point out that they have hotels and other facilities for tourist accommodation.

Analysis of tourist traffic and economic aspect of sustainability of Donje Podunavlje

Donje Podunavlje records the increase number of tourists and the decrease of number of tourist nights in the period from 2000 to 2016 (Table 1 and Table 2). All observed municipalities of Donje Podunavlje except Golubac and Majdanpek record the increase of number of tourist in the period from 2000 to 2016.

Table 1. *Tourists in Donje Podunavlje in period from 2000 to 2016 (in index)*

Municipality	2000	2005	2010	2015	2016
Veliko Gradište	100.00	160.50	149.45	289.50	289.50
Golubac	100.00	89.28	88.23	52.81	52.81
Majdanpek	100.00	100.58	86.83	82.80	82.80
Kladovo	100.00	93.39	123.03	103.33	103.33
Negotin	100.00	172.62	140.82	154.67	154.67
Donje Podunavlje	100.00	105.64	107.75	108.98	108.98

Source: *Statistical Office the Republic of Serbia, www.stat.gov.rs/en-us/publikacije/*

Veliko Gradište records the increase of tourist nights from 2000 to 2005 and from 2010 to 2015. Golubac, Majdanpek, Kladovo and Negotin record the decrease of tourist nights in period from 2000 to 2016.

Table 2. *Tourist nights in Donje Podunavlje in period from 2000-2016 (in index)*

Municipality	2000	2005	2010	2015	2016
Veliko Gradište	100.00	118.70	67.08	188.41	63.77
Golubac	100.00	74.91	79.97	45.04	31.61
Majdanpek	100.00	69.55	60.02	43.43	24.32
Kladovo	100.00	81.59	125.48	73.35	37.49
Negotin	100.00	63.02	72.69	94.10	33.31
Donje Podunavlje	100.00	79.22	82.71	74.27	34.24

Source: *Statistical Office the Republic of Serbia, www.stat.gov.rs/en-us/publikacije/*

All observed municipalities of Donje Podunavlje record the decrease of average length of stay of tourists in the period from 2000 to 2016. Majdanpek records the highest decrease of average length of stay of tourists while Golubac records the lowest decrease of average length of stay of tourist in the period from 2000 to 2016.

Table 3. *Average length of stay of tourists in Donje Podunavlje in period from 2000 to 2016 (in index)*

Municipality	2000	2005	2010	2015	2016
Veliko Gradište	100.00	74.01	66.96	64.98	64.98
Golubac	100.00	83.83	113.17	85.03	85.03
Majdanpek	100.00	69.12	115.29	52.65	52.65
Kladovo	100.00	80.80	81.16	71.01	71.01
Negotin	100.00	36.64	71.12	60.78	60.78
Donje Podunavlje	100.00	73.27	92.77	68.24	68.24

Source: *Statistical Office the Republic of Serbia, www.stat.gov.rs/en-us/publikacije/*

Research methodology

The survey was conducted in hotels that are located in the Donje Podunavlje (Veliko Gradište, Golubac, Majdanpek, Kladovo and Negotin). 1000 guests were surveyed. After elimination of questionnaires with incomplete answers, we got a useful sample of 992 questionnaires.

Table 4. *Respondents profiles*

Attributes/distribution	Sample number	Frequency (%)
Gender		
Male	532	53.63
Female	460	46.37
Age		
18 or younger	52	5.24
19-29	259	26.11
30-39	205	20.67
40-49	223	22.48
50-59	98	9.88
60 or older	155	15.63
Education		

Attributes/distribution	Sample number	Frequency (%)
Primary	32	3.23
Secondary	336	33.87
College	249	25.10
Faculty	214	21.57
Doctorate	163	16.43

Source: *Prepared by the authors.*

Guests are respondents rated the main competitiveness factors with a score from 1 to 5 from the standpoint of the competitiveness of Veliko Gradište, Golubac, Majdanpek, Kladovo and Negotin as tourism destinations. Starting from the average score of the main competitiveness factors, the tourism competitiveness of observed destinations are quantified.

Starting from the main competitiveness factors, it can be concluded that the nature resources of Kladovo recorded by the highest score in relation to other observed factors. The cultural and historical heritage in Negotin recorded by lowest score whiles the cultural and historical heritage in Majdanpek recorded by the highest score. Image of Golubovac recorded by the lowest score, followed by tourism offer i.e. hotels offer. The main problems of competitiveness of observed tourism destinations are: accessibility, infrastructure and price/value.

Majdanpek records the highest destination competitiveness while Negotin records the lowest destination competitiveness. According to destination competitiveness, Kladovo is found on the second place, after Majdanpek.

Table 5. *Tourist perception of main competitiveness factors of Donje Podunavlje*

Main competitiveness factors	Veliko Gradište	Golubovac	Majdanpek	Kladovo	Negotin
1. Nature resource	3.80	3.74	3.68	4.50	2.78
2. Cultural and historical heritage	3.24	4.14	4.32	3.90	2.84
3. Special events	3.32	2.96	3.98	4.12	3.22
4. Entertainment	3.04	3.68	4.3	3.72	4.16
5. Accessibility	3.16	2.96	3.52	3.04	3.22
6. Infrastructure	3.10	3.04	2.90	3.70	2.34
7. Price/value	3.46	3.42	3.86	3.10	3.36

Main competitiveness factors	Veliko Gradište	Golubovac	Majdanpek	Kladovo	Negotin
8. Safety/security	4.52	4.44	3.54	4.32	4.14
9. Image	2.00	1.68	4.48	3.52	2.20
10. Hotels	4.42	1.94	4.04	3.72	2.46
11. Human resources in hotels	3.42	3.54	3.64	3.84	4.02
12. Services quality	3.42	2.86	2.84	3.00	2.96
13. Tourism competitiveness	3.41	3.20	3.76	3.71	3.14

Source: *Prepared by the authors (SPSS Statistics 19).*

Correlation between the economic aspect of tourism sustainability and tourism competitiveness in the observed destinations was tested by calculating the Pearson correlation coefficient between the average length of stay of tourists and the level of tourism competitiveness. Results of the correlation analysis are shown in Table 6.

Based on the results of correlation analysis, it can be concluded that there is no significant correlation between the average length of stay of tourists and tourism competitiveness, since the value of Sig. is greater than 0.05. Based on the results of correlation analysis, it can be concluded that the first hipothesis has not been confirmed because the increase of tourism competitiveness of observed destination does not contribute the increase of average length of stay of tourists.

Table 6. *Pearson's correlation coefficient - the interdependence between the average length of stay of tourists, tourism competitiveness and human resources in hotels*

		Average length of stay of tourists	Tourism competitiveness	Human resources in hotels
Average length of stay of tourists	Pearson Correlation	1	-.286	.162
	Sig. (2-tailed)		.641	.794
	N	5	5	5
Tourism competitiveness	Pearson Correlation	-.286	1	-.112
	Sig. (2-tailed)	.641		.858
	N	5	5	5

		Average length of stay of tourists	Tourism competitiveness	Human resources in hotels
Human resources in hotels	Pearson Correlation	.162	-.112	1
	Sig. (2-tailed)	.794	.858	
	N	5	5	5

Source: *Prepared by the authors (SPSS Statistics 19).*

Table 7. *The value of regression coefficients – the impact of human resources in hotels on destination competitiveness*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sig.
1	.112[a]	.012	-.317	.32643	.858

Source: *Prepared by the authors (SPSS Statistics 19).*
a. Predictors: (Constant), Human resources in hotels
b. Dependent Variable: Tourism competitiveness

Based on the results of the regression method, one can conclude that the human resources in hotels have not a significant impact on the competitiveness of the municipalities of Donje Podunavlje. Based on the results of regression analysis, it can be concluded that the second hypothesis has not been confirmed because the human resources in hotels is one of the most important factors of destination competitiveness.

Conclusion

The paper has paid special attention to the analysis of competitiveness of the municipalities of Donje Podunavlje as tourism destinations. A compare analysis of foreign tourists, foreign tourist nights and destination competitiveness has led to the conclusion that Majdanpek is the leader both in terms of the tourism traffic and in the field of competitiveness as tourism destinations. Kladovo records the highest total and domestic number of tourists while Veliko Gradiste records the highest total and domestic night of tourists in 2016. All municipalities of Donje Podunavlje record the decrease of average length of stay of tourists in period from 2000 to 2016. Correlation analysis between the average length of stay of tourists and competitiveness of the observed tourist destinations has indicated that there is no significant independence between observed variables.

The natural resources and cultural and historical heritage are not enough that one municipality or town become an attractive and competitive tourism destination. First of all, investments are needed, in infrastructure and tourism superstructure. Second, it is necessary to create and implement marketing strategy and promotion strategy with the aim to development the image of Donje Podunavlje and its municipalities.

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INTEGRATION OF MARKET OF AGRI-FOOD PRODUCTS OF WESTERN BALKANS COUNTRIES IN PROCESS OF ACCESSION TO THE EUROPEAN UNION[1]

Stanislav Zekić[2], Bojan Matkovski[3]

Abstract

The current integration processes in the countries of the Western Balkans have induced numerous changes on the market of agri-food products. Namely, all countries of the Western Balkans have been in the process of adjusting the economic system to the EU rules, and are currently in different phases of the EU accession. In order to improve regional cooperation and preparation for the EU membership, all Western Balkan countries have signed the CEFTA agreement, which is the highest factor in intra-regional trade, bearing in mind the fact that these countries are natural trading partners with convergent economies of similar level of competitiveness. In order to analyze the level of integration of the agri-food market of the Western Balkan countries, using the index of intra-industry trade (GLIIT), the level of integration of the market of agri-food products with the regional, European and world market was determined. The results of the research point to the specialization in foreign trade exchange of agri-food products, e.g. to the high degree of market integration of these products with world markets.

Key words: *Western Balkans, agri-food products, index of intra-industry trade.*

Introduction

The current policy of the Western Balkans, which is characterized by integration with the international market, has been faced with a number of changes in the sector of agriculture and food industry. As the Western Balkan countries are in

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2 Stanislav Zekić, Ph.D., Full Professor, University of Novi Sad, Faculty of Economics in Subotica, Department of Agricultural Economics and Agribusiness, Segedinski put no. 9-11, 24000 Subotica, Serbia, Phone: +381 21 48 52 923, E-mail: zekics@ef.uns.ac.rs

3 Bojan Matkovski, Teaching Assistant, University of Novi Sad, Faculty of Economics in Subotica, Department of Agricultural Economics and Agribusiness, Segedinski put no. 9-11, 24000 Subotica, Serbia, Phone: +381 24 628 046, E-mail: bojan.matkovski@ef.uns.ac.rs

the process of adjusting the economic system to the rules of the European Union (EU) and the World Trade Organization (WTO), there have been numerous changes to the market of agri-food products, that are results from actual integration, but also results of needs of these countries to respect the rules and principles in the international trade of these products that are regulated within the WTO.

Table 1. *Progress of the Western Balkan countries in the EU accession process*

Country	Autonomous Trade Measures (ATM)	Stabilization and Association Agreement (SAA)	Status in EU accession negotiations
Serbia	2000	2013	Candidate country (candidate status from 2012)
Bosnia and Herzegovina	2000	2015	Potential candidate country (submitted an application for EU accession in 2016)
Croatia	2000	2005	Member State (EU Member State from 2013)
FYR Macedonia	2000	2004	Candidate country (candidate status from 2005)
Montenegro	2000	2010	Candidate country (candidate status from 2010)
Albania	2000	2009	Candidate country (candidate status from 2014)

Source: *European Commission, 2018*

After the turbulent period of transformation from a centrally-planned to a market-oriented economy, all the countries of the Western Balkans clearly highlighted integration into the EU as their strategic goal. Considering the geographical position of the Western Balkan countries, this region is very important for the EU because of security, stability, trade, and transit. For this reason, the economic and political prospect of these countries, as well as their future within the EU, is one of the important priorities in the EU. Economies of the countries of the Western Balkans are already closely related to the EU; the EU is their most important trading partner, the largest source of foreign direct investment and other financial resources, and the main destination for external migration (Dabrowski, Myachenkova, 2018). The countries of the Western Balkans are currently at different stages of accession to the EU (Table 1); In 2013, Croatia became a member state of the EU, while all remaining Western Balkan countries are in the process of European integration; Bosnia and Herzegovina has the status of

a potential candidate for membership, while the other Western Balkan countries are candidate countries for EU membership.

In order to improve regional cooperation and better prepare for EU membership, all the Western Balkan countries have become members of CEFTA (*Central European Free Trade Agreement*) since 2007. CEFTA represents the highest factor in intra-regional trade between the countries of the Western Balkans because these countries are natural trading partners with convergent economies of similar level of competitiveness (Dragutinović Mitrović, Bjelić, 2015). Geographical proximity, as well as cultural similarity, generally has a deeper connection, and the countries of the Western Balkans have specific characteristics that give them good prerequisites for regional cooperation (World Bank, 2008):

- The majority of the Western Balkan countries were part of the single market of the Socialist Federal Republic of Yugoslavia, so significant benefits could be achieved in reintegration, for example, in supply chains;
- The countries of the Western Balkans are generally small economies, and many benefits can be achieved through participation in a larger regional market;
- The numerous geographical and ethnic factors lead to the growth of interdependence of these countries: the similarity of language, the common ethnic minority, the geographical specificity of Croatia that surrounds Bosnia and Herzegovina, and
- All the countries of the Western Balkans are striving to be member of the EU, which means they have the same long-term regulatory framework.

Additional prerequisites for regional market integration can be consumer habits, good recognition of products by consumers. Also, these countries have a generally lower level of market complexity in relation to the EU market, because the different standards are applied in the process of production, processing, and distribution of agri-food products. The CEFTA agreement has achieved several positive effects on inter-regional cooperation (Michele, 2011): there has been an improvement in commercial relations and the growth of trade between these countries, but also a better flow of information, ideas and production methods. Improving business cooperation in the Western Balkans region has further strengthened the links between people and cultures, because the previous period for these countries was characterized by numerous disagreements, and even wars between certain countries.

Material and methods

To determine the significance of intra-industry trade of a particular section, division, or commodity group in total trade between the two countries (regions), the most commonly used is the index of intra-industry trade (*Grubel-Lloyd intra-industry trade - GLIIT*) which is established by Grubel, Lloyd (1975):

$$GLIIT_j = \left[1 - \frac{\sum_j | X_{ij} - M_{ij} |}{\sum_j | X_{ij} + M_{ij} |}\right] * 100$$

Where is: X – export; M – import; i – country; j – section, division, commodity group.

The index of intra-industry trade determines the level of integration of a particular section, division or commodity group with a particular market, as well as the ability to compete with main competitors. The index of intra-industry trade in literature has been widely used in the analysis of intra-industry specialization, e.g. in papers Bojnec et al., 2005; Nikolić et al., 2011; Božić, Nikolić, 2013; Matkovski et al., 2017. The value of this index closer to 100% indicates intra-industry trade, which implies a higher level of economic integration of the section, division or commodity group with a certain market, as well as adjustment of market conditions at lower costs. The value of this index greater than 15% indicates intra-industry trade, which implies that the section, division or commodity group is significantly integrated with a particular market or that there is significant intra-industry trade of that section, division or commodity group (Bojnec et al., 2005; Božić, Nikolić, 2013).

In this paper, using GLIIT, the level of integration of the markets of certain countries of the Western Balkans is analyzed, and the data from the UN Comtrade database was used in the analysis. The period of analysis is 2005-2016 and the level of specialization in the trade of agri-food products for all Western Balkan countries on the international market, as well as in the regional market (CEFTA), has been analyzed. Also, the level of integration of certain section and divisions within agri-food products are analyzed in order to identify the differentiations in the degree of integration of different segments of market of agri-food products.

Results and discussion

The largest exporter of agri-food products in the Western Balkans region is Serbia, which, on average, exported these products over 2 billion USD annually, followed by Croatia which exported these products annually about 1.5 billion USD. Regarding the dynamics of exports of agri-food products, the growth of exports in the analyzed period was recorded in all countries of the Western Balkans; the largest increase in exports of agri-food products was in Serbia, where exports grew at an average annual rate of 10.3%. Also, high growth rates recorded Bosnia and Herzegovina and Albania, where exports had an average annual growth rate of 9.8% and 9.0%, respectively (Table 2).

The growth of exports of agri-food products is a consequence of the changed conditions of trade, as well as the established export liberalization in the form of ATM with the EU, as well as the CEFTA agreement within the Western Balkan countries. Although the global economic crisis is present in the analyzed period, based on the analyzed indicators, it can be noticed that it did not negatively affect the export of these products, primarily due to the specific role of these products. Namely, agri-food products are used for satisfying the basic human needs, so the usage of these products cannot be easily reduced. Because of that, the global economic crisis has not hit the agri-food sector, as is the case with other sectors (Stojanović et al., 2013). In this period, as a consequence of liberalization of market (EU and CEFTA), the volume of foreign trade of agri-food products increased significantly. According to previous researches, the bilateral trade of agri-food products in the Western Balkan countries increased 48% on average as a consequence of EU integration, while the CEFTA agreement affected the growth of bilateral trade averagely for 129% (Matkovski et al., 2018).

Table 2. *Tendencies in foreign trade of agri-food products of the Western Balkan countries*

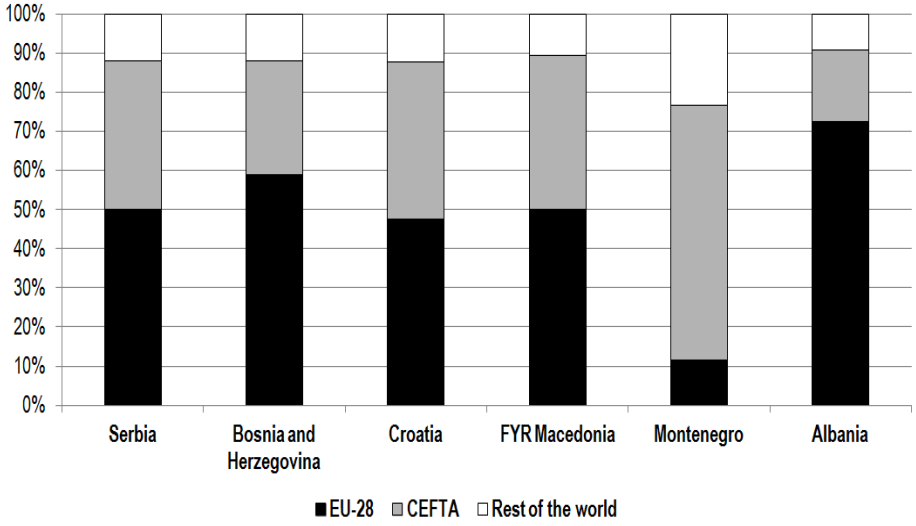
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EXPORT OF AGRI-FOOD PRODUCTS												
Serbia	923	1.267	1.686	1.956	1.945	2.244	2.480	2.707	2.804	3.072	2.870	3.186
Bosnia and Herzegovin	181	217	272	344	333	408	471	456	504	481	492	553
Croatia	949	1.215	1.334	1.415	1.372	1.373	1.585	1.612	1.596	1.766	1.751	1.961
FYR Macedonia	345	399	474	487	499	559	651	614	668	644	539	586
Montenegro		52	56	64	60	67	79	82	82	128	64	60
Albania	60	71	87	96	87	99	123	131	151	99	146	202
IMPORT OF AGRI-FOOD PRODUCTS												
Serbia	779	914	1.129	1.472	1.006	1.040	1.331	1.490	1.630	1.646	1.496	1.405
Bosnia and Herzegovin	1.268	1.332	1.601	1.999	1.634	1.746	2.033	1.922	1.932	1.938	1.679	1.703
Croatia	1.648	1.880	2.165	2.621	2.236	2.169	2.592	2.541	2.791	3.071	2.806	2.907
FYR Macedonia	430	460	631	779	693	704	857	870	865	855	773	791
Montenegro		292	432	625	556	534	612	572	603	640	521	538
Albania	460	545	696	871	788	836	912	859	878	547	638	673
FOREIGN TRADE BALANCE OF AGRI-FOOD PRODUCTS												
Serbia	143	353	557	484	938	1.204	1.149	1.217	1.174	1.427	1.374	1.781
Bosnia and Herzegovin	-1.087	-1.116	-1.329	-1.656	-1.301	-1.339	-1.562	-1.466	-1.428	-1.457	-1.187	-1.150
Croatia	-699	-665	-832	-1.206	-864	-796	-1.007	-929	-1.195	-1.305	-1.055	-946
FYR Macedonia	-85	-61	-157	-293	-194	-145	-207	-255	-197	-211	-235	-205
Montenegro		-241	-376	-561	-496	-467	-533	-490	-521	-513	-457	-478
Albania	-400	-474	-609	-776	-701	-738	-789	-728	-727	-448	-492	-471

Source: *UN Comtrade, 2018.*

The highest value of imports of agri-food products in the analyzed period was realized in Croatia, where value of import was about 2.5 billion USD averagely annually. It is followed by Bosnia and Herzegovina and Serbia, where averagely annual import of agri-food products was about 1.7 billion USD and 1.3 billion USD, respectively. In all Western Balkan countries, imports of agri-food products increased in the analyzed period: the largest increase in imports of agri-food products was in Serbia, where imports grew at an average annual rate of 5.6%, and high growth rates were in FYR Macedonia and Croatia, where imports had an average annual growth rate of 5.3% and 4.7%, respectively.

As the foreign trade balance of agri-food products in the countries of the Western Balkan is concerned, it is obvious that only Serbia permanently achieves a positive foreign trade balance with these products, with the tendency of growth by annual growth rate of 20%, averagely. All other Western Balkan countries have a negative foreign trade balance in the exchange of agri-food products, and the biggest deficit is evident in Bosnia and Herzegovina and Croatia.

Figure 1. *Regional structure of export of agri-food products of the Western Balkan countries*

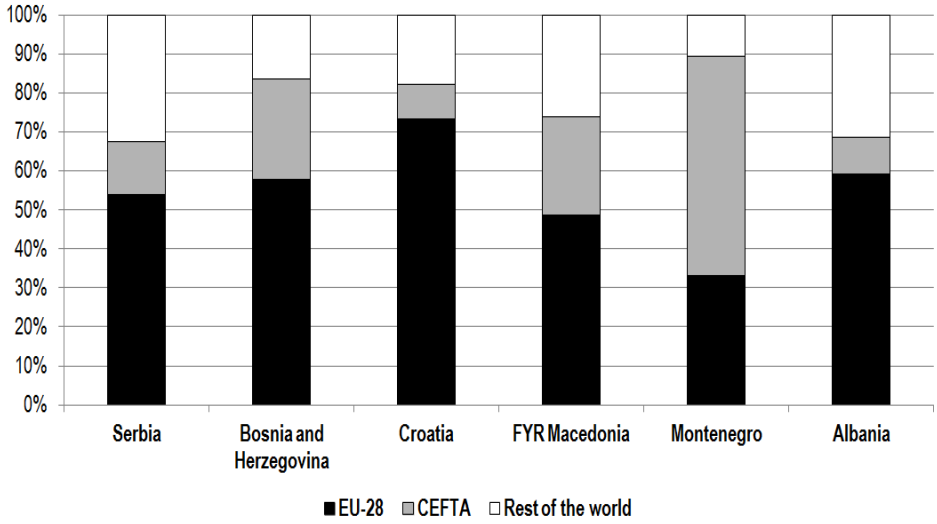


Note: *Average for period 2005-2016*
Source: *Authors calculations on basic of UN Comtrade, 2018.*

Analyzing the regional allocation of exports of agri-food products of the countries of the Western Balkans (Figure 1), the largest percentage of these products is placed in EU countries: in Serbia, about 50.0% of agri-food products were exported to EU countries in the period 2005-2016. At the same time, other countries of the Western Balkan were exported significant part of agri-food products to the EU: Bosnia and Herzegovina 58.9%, Croatia 47.4%, FYR Macedonia 50.1%, Albania 72.5%. On the other hand, export of agri-food products from Montenegro to EU countries accounted for about 11.5% of exports of these products. CEFTA countries are dominant export market for agri-food products from Montenegro (65% of agri-food export was in CEFTA countries). In the rest of the Western Balkan countries, the CEFTA market is also very

important, so in the analyzed period, on average, exports to this market were: in Serbia 38.0% of total exports of agri-food products, in Bosnia and Herzegovina 28.9%, in Croatia 40.2%, and FYR Macedonia 39.2%. The percentage of exports of agri-food products to other countries of the Western Balkans is only slightly lower in Albania (18.2%), which is logical bearing in mind the great differences between the markets of Albania and other Western Balkan countries that were part of the Former Socialist Federal Republic of Yugoslavia. Foreign trade between Albania and other Western Balkan countries is at a low level primarily due to large differences in language, religion, and historical circumstances that also have an impact on trade. Namely, the ability of the population to communicate directly, as well as the similar religious structure of the population, are two important factors that influence the formation of foreign trade between countries (Trivic, Klimczak, 2015).

Figure 1. *Regional structure of import of agri-food products of the Western Balkan countries*



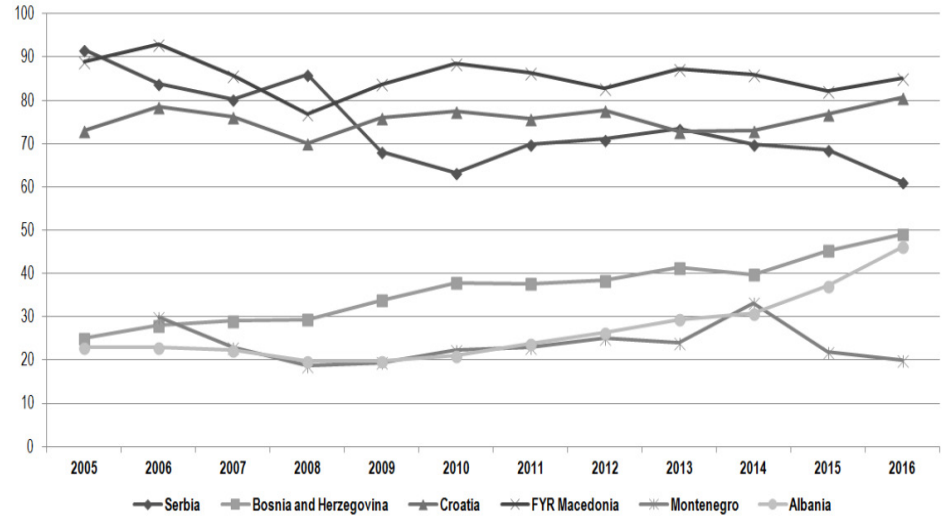
Note: *Average for period 2005-2016*
Source: *Authors calculations on basic of UN Comtrade, 2018*

The regional structure of imports of agri-food products in certain Western Balkan countries (Figure 2) shows that EU countries are the dominant import market, as it was case in the export of these products. In Croatia, the EU is the dominant import market for agri-food products, and in the analyzed period, about 73.3% of

these products were imported from EU member states. In the other Western Balkan countries a large part of the imports of these products was also realized from the EU: in Albania 59.1%, in Bosnia and Herzegovina 57.8%, in Serbia 53.9%, in FYR Macedonia 48.5%, and in Montenegro 33% of these products were imported from the EU. The CEFTA market is very important in the import of agri-food products in Montenegro, where 56.5% of the total imports of these products were realized from CEFTA countries, while on the other hand in Albania only about 9.5% of the import of agri-food products was realized from CEFTA countries.

In order to analyze the level of specialization of market of the Western Balkan countries on the world market, as well as in the markets of EU countries and CEFTA countries, the values of the index of intra-industry trade for agri-food products of these countries are examined (Figure 3). Considering the values of the intra-industrial exchange index, it can be concluded that the intra-industry specialization of agri-food products prevails in all countries of the Western Balkans. The high values of the index of intra-industrial exchange of agri-food products point to the specialization in foreign trade, as well as the high level of market integration of these products with the world market.

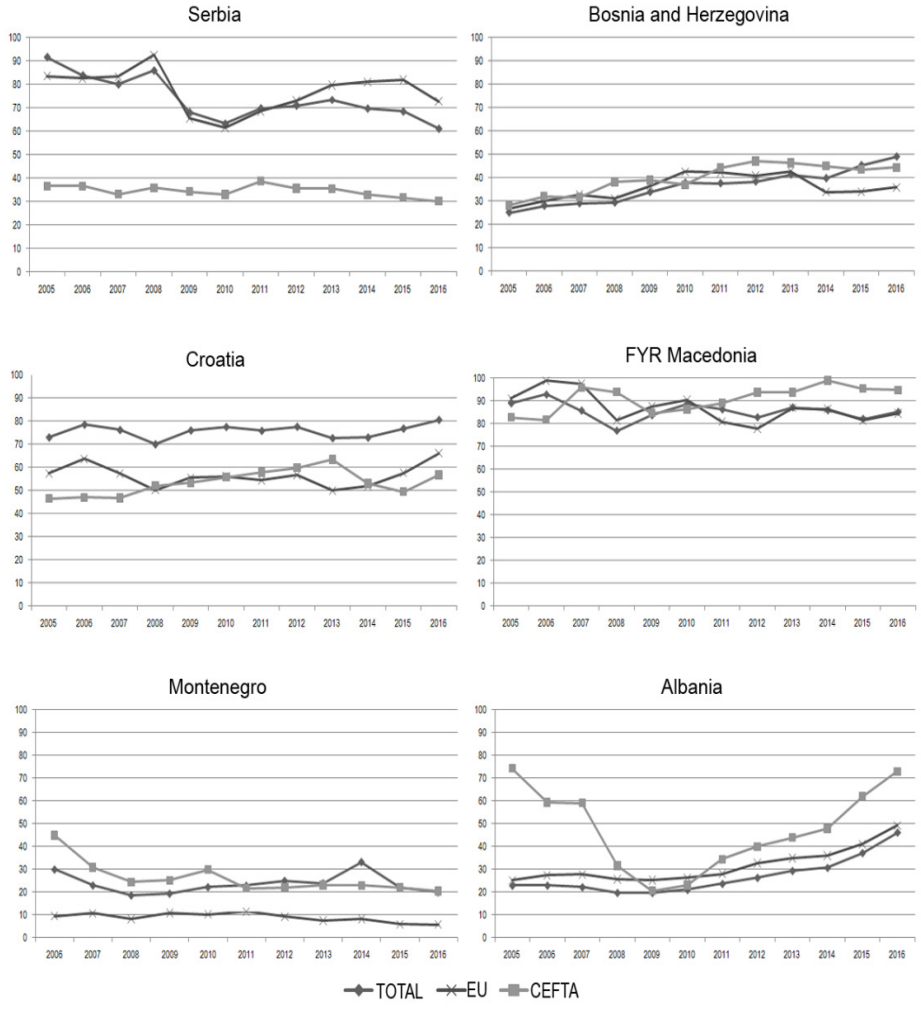
Figure 3. *Index of intra-industry trade of agri-food products of the Western Balkan countries*



Source: *Authors calculations on basic of UN Comtrade, 2018.*

The highest level of integration, i.e. the highest value of the index of intra-industry trade of agri-food products is realized in FYR Macedonia, and it is followed by Croatia and Serbia. Significantly lower level of integration of agri-food market, but still at the level of significant intra-industry trade above 15%, have the markets of agri-food products of Bosnia and Herzegovina and Albania. These two countries are characterized by the highest growth of level of integration of agri-food market in the analyzed period. The lowest level of integration of agri-food products with the international market was in Montenegro.

Figure 4. *Index of intra-industry trade of agri-food products of the Western Balkan countries by main foreign trade destinations*



Source: *Authors calculations on basic of UN Comtrade, 2018.*

The index of intra-industry trade is analyzed for foreign trade of agri-food products on the international market, as well as on the main trade destinations: EU and CEFTA countries (Figure 4). Considering the values of the intra-industry trade index, it can be concluded that the intra-industry specialization of agri-food products is dominant, both on the world market and on the markets of EU countries and countries of the CEFT. High degree of integration with all analyzed markets is noticeable in FYR Macedonia, while in Montenegro is the worst situation. Integration of Montenegro market of agri-food products with EU market is even lower than 15%, which points to inter-industry trade. A higher degree of integration with the EU market is noticeable in Serbia and Croatia, the countries of the Western Balkans where the highest value of trade of agri-food products is achieved. In all other analyzed countries, it is noticeable a higher level of integration with the regional market (CEFTA) than integration with the EU market.

Considering the differences in the level of integration of the agri-food market in certain sections and divisions (Table 3), it is noticeable that the section of crude materials (section "2") has the highest degree of market integration in almost all analyzed countries. Also, the section of beverage and tobacco (section "1"), whose products are well integrated with the international market in all countries, except in Albania, has also good level of integration. Section of food and live animals (section "0") has a high degree of integration in Serbia and Croatia, while the lowest level of integration is noticeable in Albania. In the majority of Western Balkan countries, the largest degree of integration in this section has a division of vegetables and fruit.

The analysis of the degree of integration of agri-food products of **Serbia** with the international market in certain sections and divisions indicates that the highest level of integration have tobacco and tobacco products (the average for analytical period is 98.43%), and this division also records the highest increase in integration, at an average annual rate of 14%. High degree of integration with the international market is also noticeable in the following divisions of Serbia's agri-food products: miscellaneous edible products and preparations, animal or vegetable fats and oils, oil-seeds and oleaginous fruits, as well as meat and meat preparations.

High level of integration, i.e. high values of the index of intra-industry trade of agri-food products in Bosnia and Herzegovina, is noticeable in divisions hides, skins and furskins, then fixed vegetable fats and oils, as well as divisions from the section "0": dairy products and eggs and vegetables and fruit. The highest increase

in the integration of the agri-food products market of Bosnia and Herzegovina with the international market is noticeable in divisions meat and meat preparations, as well as tobacco and tobacco products.

Table 3. *Index of intra-industry trade of agri-food products of the Western Balkan countries in period 2005-2016*

SECTON/DIVISION	Serbia	Bosnia and Herzegovina	Croatia	FYR Macedonia	Montenegro	Albania
FOOD AND LIVE ANIMALS	**70,88**	**34,30**	**71,65**	**65,59**	**14,32**	**0,00**
Live animals	71,51	9,12	43,23	92,16	0,18	4,89
Meat and meat preparations	87,33	37,87	49,20	35,06	20,88	5,70
Dairy products and birds' eggs	72,11	56,47	58,64	31,53	1,06	15,43
Fish (not marine mammals), crustaceans, molluscs and aquatic invertebrates, and preparations thereof	13,10	44,89	83,43	42,40	6,02	90,48
Cereals and cereal preparations	24,48	27,86	88,66	68,94	12,70	3,34
Vegetables and fruit	65,86	54,92	31,16	65,47	31,98	40,90
Sugars, sugar preparations and honey	38,30	46,94	87,79	31,47	4,85	1,08
Coffee, tea, cocoa, spices, and manufactures thereof	58,83	18,02	61,24	30,31	11,97	7,86
Feeding stuff for animals (not including unmilled cereals)	81,44	18,85	46,52	7,15	1,79	19,52
Miscellaneous edible products and preparations	92,20	16,58	97,23	39,05	12,83	2,01
BEVERAGES AND TOBACCO	**78,35**	**20,60**	**94,38**	**46,97**	**54,30**	**10,96**
Beverages	59,09	19,63	95,13	61,67	60,65	10,84
Tobacco and tobacco manufactures	98,43	22,99	76,93	36,39	26,60	11,08
CRUDE MATERIALS, EXCEPT FUELS	**97,35**	**68,14**	**94,42**	**63,12**	**82,70**	**47,49**
Hides, skins and furskins, raw	76,15	89,29	77,85	62,30	16,71	18,33
Oil-seeds and oleaginous fruits	88,42	5,68	49,18	28,70	2,13	3,24
Crude animal and vegetable materials, n.e.s.	63,44	25,03	35,82	38,30	97,55	78,24
Silk, cotton, jute, vegetable textile fibres, wool and other animal hair	81,10	36,14	38,94	61,30	11,00	52,81
ANIMAL AND VEGETABLE OILS, FATS AND WAXES	**50,36**	**70,30**	**45,04**	**31,08**	**20,15**	**4,23**
Animal oils and fats	70,22	0,07	50,68	2,00	92,91	0,60
Fixed vegetable fats and oils, crude, refined, or fractioned	44,46	76,85	40,44	32,62	12,37	4,50
Animal or vegetable fats and oils, processed	90,96	3,55	73,44	19,75	41,55	5,06

Source: *Authors calculations on basic of UN Comtrade, 2018.*

Analyzing the index of intra-industry trade of agri-food products of Croatian market, it could be concluded that all sections and divisions are integrated with the international market, i.e. the intra-industry character of the exchange prevails. Division of miscellaneous edible products and preparations has the highest integration level with international market, and this division is followed by divisions: beverages, cereals and cereal preparations and sugars, sugar preparations and honey.

The highest value of the index of intra-industry trade in FYR Macedonia has division of live animals (92.16% on the average for the analyzed period), and level of integration of this division has also the highest growth rate in the observed period. The divisions that are lower integrated with the international market, i.e. the divisions which index of intra-industry trade is less than 15%, are divisions of feeding stuff for animals and animal oils and fats.

Montenegro has the worst results of all Western Balkan countries when it comes to the levels of market integrations of agri-food products. A large number of sections and divisions in which agri-food products are classified have an index of intra-industry trade on level less than 15%. High level of integration with international market is recorded for the commodity groups silk, cotton, jute, vegetable textile fibres, wool and other animal hair, as well as divisions animal oils and fats and beverages.

As in the case of Montenegro, Albania also has a relatively low level of integration of market of agri-food products with the international market, and a large number of divisions have an index of intra-industry trade on level less than 15%. The highest values of the index of intra-industry trade in Albania are realized by a divisions fish, crustaceans, molluscs and aquatic invertebrates, and preparations thereof, as well as silk, cotton, jute, vegetable textile fibres, wool and other animal hair. It is noticeable that significant growth of integration with the international market is recorded in division vegetables and fruit.

Conclusion

Adapting the markets of the Western Balkans to the market economies of the developed European countries began at the end of the 20th century, and the reform processes have progressed differently in these groups of countries. In the context of the current adjustment to actual international economic integration, a gradual liberalization of the markets of these countries has been established. The

extent of the changes that has been done under the influence of the liberalization achieved with the EU and the CEFTA countries is different, but it is evidently that the free trade agreements with these countries have significantly influenced the intensity and structure of foreign trade of agri-food products. Namely, according to the results of the research in this paper, the growth of exports of agri-food products is present in all Western Balkan countries. By analyzing the geographical allocation of exports, it is noticeable that most of these products are placed in EU countries, followed by CEFTA countries. On the import side, the situation is very similar; there is an increase in imports of agri-food products in all Western Balkan countries, and the EU is the dominant import market. The highest growth rate of foreign trade in agri-food products is noticeable in Serbia, which is the only one country that has a positive foreign trade balance with these products. The results of the research also point to an intra-industry specialization with the international market of agri-food products in all countries of the Western Balkans. Also, all countries have a high level of specialization with the market of these products in EU countries, as well as with CEFTA countries. The highest level of integration with the international market is observed in the crude materials section (section "2"), and the section of beverages and tobacco (section "1"), whose products are well integrated with the international market in all countries, except in Albania. Regarding the section of food and live animals (section "0"), a high degree of integration is evident in Serbia and Croatia, while the situation in Albania is not particularly favourable. In order to examine the impact of the achieved levels of intra-industry specialization with the international market, the levels of comparative advantages of certain segments of the agri-food market, as well as the factors determining the competitive positions of these products on the international market, will be analyzed more detailed.

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CHARACTERISTICS OF THE AGRICULTURAL LAND MARKET IN THE REPUBLIC OF SERBIA[1]

Vanja Erceg[2], Tihomir Zoranović[3]

Abstract

Agricultural land is a good of general interest for the entire society. It is used for the production of agricultural and food products necessary for the survival of society, and therefore requires specific treatment. Also, the market valuation of natural resources must be on different basis compared to the application of the standard supply and demand model. In 2006, the Republic of Serbia adopted the Law on Agricultural Land, which regulates planning, protection, organization and use of agricultural land, as well as other important issues related to agricultural land. Under the political pressure and in interest of certain social groups, new legal measures were adopted in 2017. Namely, since September 1st 2017, foreign citizens have been able to purchase agricultural land on the territory of the Republic of Serbia, under certain conditions. The question is why the Republic of Serbia agreed to this step before joining the European Union. The paper analyzes the ownership structure, the plant production structure and the Serbian land market.

Key words: *agricultural land, market, legal regulations, prices*

Introduction

The land is the basic factor of the environment created by the interaction of biotic and abiotic factors. The land creation processes very slow and is therefore considered conditionally renewable resource and belongs to natural resources. With growing awareness of the importance of environmental protection and human

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2 Vanja Erceg, M.Sc., University of Novi Sad, Faculty of Agriculture, Department of Agricultural Economics and Rural Sociology, Trg Dositeja Obradovića no. 8, 21000 Novi Sad, Serbia, Phone: + 381 21 485 32 33, E-mail: vanja.erceg@polj.uns.ac.rs

3 Tihomir Zoranović, Ph.D., Associate Professor, University of Novi Sad, Faculty of Agriculture, Department of Agricultural Economics and Rural Sociology, Trg Dositeja Obradovića no. 8, 21000 Novi Sad, Serbia, Phone: + 381 21 485 32 31, E-mail: tihomir@polj.uns.ac.rs

impact on the environment, as well as the fact that the land has apronounced socio-economic and agro-ecological dimension, it is necessary to develop a system of sustainable land management.

Intensive agriculture, in addition to the production of fossil fuels, is considered to be one of the most aggressive human influences on nature. Inadequate land use leads to its degradation. The concept of degradation can be defined as a set of human activities which reduce the present and future potential of the land, necessary for the survival of the living world on planet Earth. Some of the most significant processes that have a negative effect on the soil quality are floods, salinisation, erosion, land consolidation, construction of buildings and roads, reduction of soil biodiversity, reduction of organic matter, avalanches, pollution, etc.

The Environmental Protection Agency has identified 384 contaminated or potentially contaminated locations on the territory of the Republic of Serbia. The largest number of registered sources of localized soil pollution is related to waste disposal processes (43.5%), extraction and production of oil (22.5%) and industrial and commercial activities (10.2%). The Law on Land Protection (Sl. glasnik RS, no. 112/15) was adopted as the supreme act for resolving the above mentioned problems. This law regulates land protection, systematic monitoring of the condition and quality of the land, recovery measures, remediation, recultivation, inspective supervision and other issues of importance for the protection and conservation of land as a natural resource of national interest. The goal of this law is to preserve the areas and functions of the land as a natural resource and to prevent or eliminate detrimental changes in the land that may occur.

Observing the agricultural land market, it is noticeable that demand for agricultural land derives from demand for agricultural products. Growth in demand for agricultural products means growth in demand for agricultural land, as well as other inputs necessary for agricultural production. A large number of exogenous and endogenous factors effect changes in the extent to which agricultural land is used, such as the price elasticity of demand and supply of agricultural products and the price elasticity of the supply of agricultural land (Lovre et al., 2017).

Unlike other tradable goods, land is immobile. The land market exists if it is possible to exchange land use rights for an agreed amount of money. The efficiency of the land market varies around the world, along with openness towards public control and support for the concept of sustainable development. In less econom-

ically developed countries, it is not always possible to develop an efficient land market. The continuing globalization will inevitably affect the land market, especially since information technologies allow greater and faster access to information about national land resources (Mahoney et al., 2007).

The fact is that the sale and lease contracts of agricultural land are not transparent enough. The proof for this is that countries do not incorporate mechanisms for protection of the rights of domestic population in these contracts. Namely, imprecisely defined land rights, inadequate registration procedures and unclearly defined production requirements all greatly endanger the position of the domestic population. A particular threat affecting food safety and self-sufficiency in food production stems from the ubiquitous trend of control tranfer of agricultural land from domestic to foreign citizens. The increasing popularization of largeproperties is a factor that threatens the rural population. A large number of small farmers, who use traditional production methods, become discouraged and quit agricultural production. This then leads to migration of rural population and freeing the allotmentsfor investors who wish to buy or lease agricultural land. Long-term contracts for leasing agricultural land and extensive acquisition of agricultural land do not contribute to rural development (Lovre et al., 2017).

The agricultural land market size is largely dependent on the ownership structure, the structure of the current production, prices, locations, etc. It is especially important for foreign investors whether national legaslation allow or restrict the ownership of agricultural land or whether there are some conditions on the volume of investments or some other production.

National legislation on property relations and disposal of agricultural land

The Constitution of the Republic of Serbia (serbian: Ustav Republike Srbije), as the supreme legal act, guarantees the equality of all forms of property (Sl. glasnik RS, no.98/06). The Constitution knows the category of private property, public property and cooperative property. Disposal of all forms of ownership is left to the law regulations, as well as the possibility of acquiring certain rights, including the right of ownership over agricultural land. The use and disposal of agricultural and forest land in private ownership is free, but the law can regulate the forms of use and disposal.

The Law on Agricultural Land regulates planning, protection, arrangement and use of agricultural land and other issues related to agricultural land (Sl. glasnik

RS, no. 62/06, 65/08, 41/09 and 112/15). The law directs that agricultural land is a good of general interest. Also, the law directs that the owner of the agricultural land cannot be a foreign natural or legal person. However, the Republic of Serbia has reached a decision that from September 1st 2017, the sale of agricultural land to foreign citizens will be possible under certain conditions. In order for foreigners to buy Serbian agricultural land, they must have had a residence on the territory of the Republic of Serbia for at least ten years, more precisely on the territory of the local administration unit in which they wish to buy agricultural land, and they must have a registered agricultural property. It is also necessary that they own machines and equipment for agricultural production and they must have been cultivating the land for at least three years. As for the agricultural land in private property, foreign citizens may have ownership rights over two hectares at most. Also, it is forbidden to sell agricultural land to citizens of EU state members in the zone of ten kilometers from the border. These restrictive stipulations have practically suspended the right of foreign citizens to become owners of agricultural land. The aim of such legal provisions is to prevent the complete liberalization of agricultural land traffic, which was predicted in the Stabilization and Association Agreement.

Agricultural land in state ownership can be alienated only under the conditions prescribed by the Law on Agricultural Land. The sale of state-owned agricultural land was first enabled by the Law on Amendments to the Law on Agricultural Land, adopted by the parliament in 2015 (Sl. glasnik RS, no. 62/06 and 65/08). In the process of alienation, the agricultural land in state ownership may be acquired by a natural person by freight legaltransaction,with the area being limited to 20 hectares, and under the conditions (Zakon o poljoprivrednom zemljištu, Sl. glasnik RS, no. 62/06, 65/08, 41/09, 112/15 and 80/17):

- that they are a citizen of the Republic of Serbia,
- that the registered agricultural property has been in active status for at least three years or that they are a holder of an active agricultural property,
- that they meet the technical conditions ie. that they have machinery and other necessary equipment for agricultural production,
- that they own a maximum of thirty hectares of agricultural land,
- that they have had a residence in the municipality in which the agricultural land is being sold for at least five years,
- that in the last three years they have not alien at Edmore than three hectares of their own agricultural land, unless in order to satisfy public interest,
- that the total area that the natural person will own after purchasing does not exceed forty hectares and

- that they have no unsettled commitments regarding the lease of state-owned agricultural land.

At the same time, the law determines that the object for sale can be agricultural land in state ownership if it is at least ten kilometers away from the state border. With the approval of the Government of the Republic of Serbia, that distance may be reduced, and this is assessed for each individual case after previously obtaining the opinion of the Ministry responsible for defense affairs and the Ministry responsible for internal affairs, provided that the land is not intended for another purpose by a valid planning document, that it is not an object of restitution, that it does not belong to protected natural areas, that it does not belong and does not border with a security zone or a military zone. Also, a natural person cannot acquire ownership of agricultural land in the area of the administrative line towards the AP Kosovo and Metohija.

The law allows the leasing of state-owned agricultural land to a natural or a legal person (if it is predicted for this purpose by the annual program of protection, arrangement and use of agricultural land) for a period which may not be shorter than one year, but not longer than thirty years, while for vineyards and fish ponds, a lease period of forty years is predicted. The law does not explicitly specify whether foreign legal and natural persons can be leaseholders of agricultural land, but does not prohibit the said persons from leasing.

The privatization process

According to the Report on privatization and disposal of agricultural land in the public property of the Republic of Serbia, due to disobeying the Law on Agricultural Land and the Law on Privatization, tens of thousands of hectares of publicly owned agricultural land have been turned into private property without any compensation and confirmation that the buyer has settled obligations fromthe sales contract. Namely, the property for which the buyer has settled obligations could not have included the land since the seller did not have the property right, only the right to use the land. Bearing in mind that the information on ownership over agricultural land after privatization is not publicly available, it is concluded that the procedure of turning public property into private property without compensation has caused a great damage to the state.

According to the Privatization Agency information, in the period from 2002 to 2015, 148 agricultural enterprises and combines have been privatized. The revenue generated from the sale of 141 agricultural enterprises amounts to 260 million euros, while for the other seven privatized agricultural enterprises, theinformation on the selling price are not available. Namely, the Anti-Corruption Council (serbian: Savet za borbu protiv korupcije) sent a request to the Republic Geodetic Authority in 2014 to provide information on the total area of agricultural land of the 148 agricultural enterprises and combines that were in the process of privatization. Based on the obtained information, it was calculated that the area after the privatization of these agricultural enterprises and combines was 132,347 hectares. The state land had an area of 36,865 hectares, the privateland 75,674 hectares, or more than 57%, and the area of social land was only 8,647 hectares. In addition to the state, private and social ownership, an area ofapproximately 11,000 hectares waslabeled as undefined ownership of land, an area of 7,650 hectares as mixed property and an area of 3,511 hectares labeled as other forms of property (Savet za borbu protiv korupcije, 2017).

By changing the character of the society by entering the multi-party system, over 80% of the land, as the main production factor, was privatised. In agriculture as well, privatization has been set as agoal, and not as a mean to achieve some desired goal. Instead of setting goals, defining priorities and analyzing options for a new systemic approach, the privatization process has broken the existing agrarian structure, leaving long-term consequences on responsible use and land management, material, economic and social position of participants in the food chain (Simanović, 2017).

Today, in the Republic of Serbia there are several large conglomerates with the ownership of tens of thousands of hectares of agricultural land, which at the same time are owners of large processing plants and trade chains. In such a system there is no business independence of small producers, they are merely work force for the production of cheap raw materials. Also, the state leases its agricultural land and often gives it or exchanges it for poorer quality and local administrations collect part of annuities to use and spend on their local needs. Undeveloped market infrastructure needed to support small farmers, purchasing and distribution centers, and unorganized market in agricultural products all contribute to a low degree of overall competitiveness.

Restitution process

In addition to correcting the decades-long injustice that the state has committed against its citizens, restitution is also one of the key systemic changes. Without it there is no breaking free from the previous totalitarian system.This can be seen from the European Commission report, which puts restitution among the ten main conditions for faster progress of the Republic of Serbia towards EU membership (Davidović et al., 2017).

In the Republic of Serbia, the Law on Restitutionof Seized Property and Compensation was adopted in 2011. This law regulates the conditions, ways and procedures of restitution of confiscated property and compensation for seized property on the territory of the Republic of Serbia which was, by applying the regulations on agrarian reform, nationalization, sequestration and other regulations after 1945, seized from natural and legal persons and transferred to national, state, social or cooperative property (Sl. glasnik RS, no. 72/11, 108/13, 142/14 and 88/15). The Law also refers to returning the property that was seized during the Holocaust on the territory that is now part of the Republic of Serbia.

According to the information from the Restitution Agency, by the end of 2017, based on the Law on Restitution of Property to Churches and Religious Communities, the right of ownership over 58,549 hectares has been restored, out of which an area of 26,251 hectares was agricultural land, an area of 32,206 hectares was forests and forest land and 91 hectares was construction land. According to the latest information from the Centralized Database of Landed Cadastre Plots, by the September 18th 2018, in the Republic of Serbia, property rights over 46,044 hectares of land have been returned, while the remaining area is 56,391 hectares.

Available agricultural land by categories of use

The Republic of Serbia is considered to be one of the European countries with favorable land resources. Observing the structure and the extent of available agricultural land, the Republic of Serbia has 0.46 hectares of land per capita at disposal. Out of the total territory of the Republic of Serbia, about 60% represents agricultural land, and 82% is in the AP Vojvodina. With adequate measures for protection against erosion and other forms of degradation, preventing the placement of agricultural land at locations that are attractive to industry and trade, implementing agro-technical measures by avoiding their adverse effects and exploiting the ben-

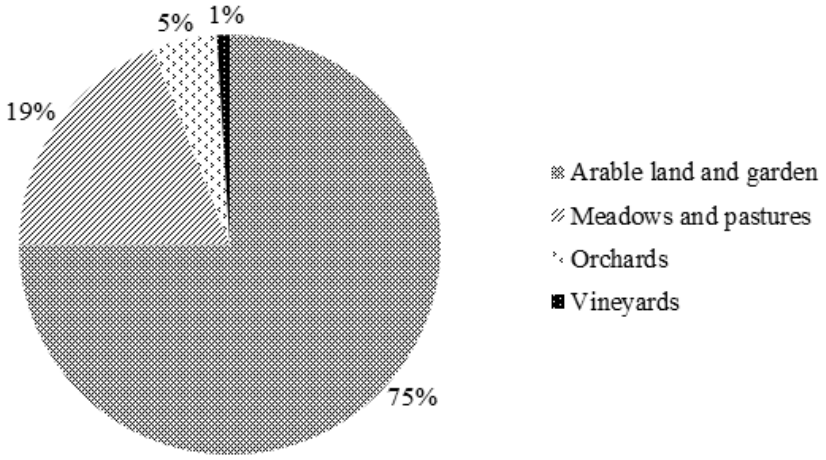
efits for the production of organic food, it is possible to achieve optimal utilization of this resource, which would provide the domestic market with quality products and make it competitive on the international market.

Regarding the land structure, the Republic of Serbia has about 5 million hectares of agricultural land at its disposal, of which 71% is extensively used in the form of orchards, arable land and vineyards, while the other 29% of the agricultural land is meadows and pastures. Most of the agricultural land, more precisely about 3 million hectares or 65%, is used as arable land, while about 7% is not used at all for agricultural production (Sl. glasnik RS, no. 85/14).

Preservation of rich land resources is endangered by widespread erosion, the application of inadequate agro-technology and factors of socio-economic nature. During the last decade, arable land has been reduced by 65.7 thousand hectares, orchards by 4.5 thousand hectares and vineyards by 13.5 thousand hectares, with the increased permanent lawns by almost 50 thousand hectares, which in total reduces the total agricultural area by 133.7 thousand hectares. The main causes of these opposing tendencies by purpose of use are using the most fertile soil for construction and other non-agricultural purposes, economic and socio-cultural demotivation for working in agricultural production, depopulation of infrastructural unequipped villages and institutional problems of agro-industrial combines (Sl. glasnik RS, no. 88/10).

In the Republic of Serbia, out of the total agricultural land area of 5,346,597 hectares, the used agricultural land dominates with 64.3%, which combined with the unused agricultural land with a share of 7.9% makes 72.2% of the total available land, followed by forest land with 19.1% and other land with 8.7% (Ševarlić, 2015). Based on the information published by the Ministry of Agriculture, Forestry and Water Management, the area of agricultural land used in 2017 has amounted to 3.4 million hectares.

Chart 1. *Structure of utilised agricultural area (UAA) by categories of use in the Republic of Serbia in 2017.*

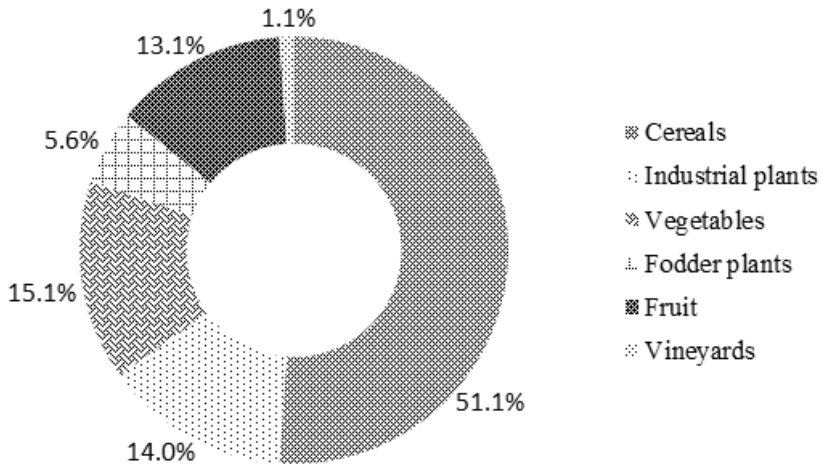


Source: *Authors calculations based on the data from the Ministry of Agriculture, Forestry and Water Management, 2017.*

The largest part, which is three quarters of the total used agricultural land, goes to fields and gardens, then, with much smaller share, meadows and pastures, and finally orchards and vineyards with the smallest share (Chart 1). The fact is that the Republic of Serbia has relatively favorable natural conditions for different types of agricultural production, both plant production and animal husbandry. However, in the total agricultural production in the Republic of Serbia, the plant production area has a dominant role with over 60%.

In the structure of plant production in the Republic of Serbia, grain production area takes first place with over 50%, arable land followed by vegetables with 15%, industrial plants with 14%, fruit growing with 13%, while fodder plants and viticulture have the smallest share (Chart 2).

Chart 2. *Plant production area structure in the Republic of Serbia in 2017*



Source: *Authors calculations based on theDatabase of the Republic Statistical Office of the Republic of Serbia, 2017.*

Purchase and lease of agricultural land in the Republic of Serbia

The price of a hectare of quality cultivable agricultural land in Vojvodina can reach up to 15,000 euros. For a hectare of land in Eastern and Southern Serbia, except in the vicinity of Požarevac and Prokuplje, it reaches a maximum of 4,500 euros, while in Vojvodina, especially around Srbobran, Stapar and Inđija, the land is soldat even3 times that price. In Central and Western Serbia, the price of land is around 5,000 euros per hectare. Values vary depending on the micro location, which is one of the most important factors regarding the soil. However, the price of agricultural land depends on many factors, such as the quality of the land, whether it is a bigger or a smaller parcel, whether it has drainage cannals or irrigation wells, whether it is near the road or deep into the area. Also, the cause of such regional price difference on the territory of a single state is also related to the problem of depopulation of villages. Namely, where there is no population, there are no interested parties in purchasing, that is, in cultivation of land, and for land, just like for everything else that is sold, the supply and demand ratio applies, and it affects the price formation.

Out of the total available agricultural land used in the Republic of Serbia, around 70% of the agricultural land is owned and the remaining 30% is on the leasingmarket. In accordance with the type of settlement, the largest area of utilised agricultural land is in rural areas. Observed regionally, the total utilised agricultural land in the Republic of Serbia is almost equally divided among the regions Serbia - North and Serbia - South. However, in the region Serbia - North there is a smaller relative difference between areas of owned agricultural land and the ones that are leased. On the other hand, in the Serbia-South region, a significantly larger share of used agricultural land is owned, while the area of leased land is relatively smaller (Table 1).

Table 1. *Utilised agricultural area (UAA) according to the ownership structure, type of settlement and regions*

	Type of settlement	Total UAA(ha)	OwnUAA (ha)	Leased UAA(ha)
Republic of Serbia	**Total**	**3,437,423.5**	**2,418,416.0**	**1,019,007.5**
	City	715,309.6	491,943.7	223,366.0
	Mixed	329,663.1	185,235.4	144,427.7
	Village	2,392,450.8	1,741,236.9	651,213.9
Serbia - North	**Total**	**1,745,285.30**	**998,421.10**	**746,864.20**
Serbia - South	**Total**	**1,692,138.20**	**1,419,994.90**	**272,143.30**

Source: *Retrieved from the paper Mitrović, M. (2015): Villages in Serbia - changes in the structure and problems of sustainable development, p. 254.*

According to the latest agriculture census from 2012, there are 631,552 registered farms in the Republic of Serbia, and approximately 71% of them are located in the region Serbia - South. Therefore, the structure of farms in certain regions in the Republic of Serbia also varies. Namely, the region Serbia - South is dominated by farms smaller than 10 hectares. On the other hand, in the region of Serbia –North, the size of farms greater than 50 hectares is more dominant. Generally speaking, a conclusion can be made that the Republic of Serbia mostly has farms with area of agricultural land being smaller than two hectares (Table 2).

Table 2. *Agricultural holdings by size of utilisedagricultural area (UAA) by region*

	Number of farms	<2ha	≥2 <5ha	≥5 <10ha	≥10 <50ha	≥50 <100 ha	≥100 ha
Republic of Serbia	**631,552**	**303,877**	**185,090**	**90,273**	**46,011**	**4,386**	**1,915**
Serbia - North	180,868	92,031	38,377	22,879	21,889	3,963	1,729
Serbia - South	450,684	211,846	146,713	67,394	24,122	423	186

Source: *Retrieved from the paper Mitrović, M. (2015): Villages in Serbia - changes in the structure and problems of sustainable development, p. 250.*

In recent years, the price of agricultural land in the Republic of Serbia has doubled. In the AP Vojvodina, the price of one hectare of agricultural land goes up to 20,000 euros, which is three times less than in the Netherlands, where agricultural land is sold for 63,000 euros. Due to the relatively low price compared to the countries of the European Union, if the Republic of Serbia does not prevent the sale of agricultural land to foreigners by legal restrictions, the demand for domestic land could be high.

Table 3. *Realized prices of agricultural land in market transactions by regions in Republic of Serbia in 2017*

Region	Number of transactions	Total sales area (ha)	Average area per transaction (ha)	Realized sales price (€)	Average price (€ / ha)
Bačka	24	44.6001	1.8583	460,633	10,328
Banat	25	33.4379	1.3375	230,735	6,900
Srem	22	37.1875	1.6903	341,467	9,182
Western Serbia	20	17.5597	0.8780	69,748	3,972
Šumadija	24	15.0696	0.6279	64,323	4,268
East Serbia	22	12.5164	0.5689	55,210	4,411
South Serbia	22	6.9999	0.3182	32,289	4,613
Total	159	167.3711	1.0526	1,254,405	7,495

Source: *Retrieved from the paper Drašković, B., Branjas, Z. (2017): Market condition of agricultural land prices, p. 191.*

From a regional point of view, the largest market prices of agricultural land were recorded in Vojvodina. In the territory of this autonomous province the prices of agricultural land ranged from 6.9 to 10.3 thousand euros per hectare. The lowest prices of agricultural land were recorded in Western Serbia, as low as 3.9 thousand euros per hectare. The average price at the level of the Republic of Serbia in 2017 was about 7.5 thousand euros per hectare (Table 3).

According to the official data of the Republic Geodetic Authority of the market of agricultural land sales in the Republic of Serbia in the period 2014-2017, the largest number of sales was realized on the territory of the municipality of Zrenjanin. The lowest price of agricultural land in 2014 was recorded in the municipality of Crna Trava, 593 euros per hectare, while in the same year the highest price of agricultural land sale was recorded in the municipality of Medijana near Niš, it being almost 63,000 euros per hectare. In the following year, the lowest selling price of agricultural land on the territory of the Republic of Serbia had a tendency to grow. Namely, the lowest price for agricultural land in 2015 was 752 euros per hectare, and it was recorded in the municipality of Boljevac. The highest price of agricultural land in the same year has also increased compared to the previous year, and amounted to about 75,200 euros per hectare in the territory of the municipality of Rakovica near Belgrade. In 2016, the lowest price of agricultural land sale declines. In the municipality of Majdanpek, the price of agricultural land was 722 euros per hectare. On the other hand, the maximum sale price of agricultural land continues to grow. On the territory of Novi Beograd municipality, the price of agricultural land was estimated at about 78,000 euros per hectare. The trend ofthe decreasing minimum selling price continued in 2017, with proof found in the recorded selling price in the municipality of Mali Zvornik of only 690 euros per hectare.

On the territory of the AP Vojvodina is a bigger part of the agricultural land that is leased and the price of the rent vary from municipality to municipality. The lease price of agricultural land depends on the land class and the region in which the arable land is located.

Based on the official data of the Republic Geodetic Authority of the market of lease of agricultural land in the Republic of Serbia in the observed period from 2013 to 2017, oscillations in prices of lease of agricultural land are noticeable. Namely, in 2013 the largest lease price for agricultural land was recorded in the municipality of Temerin, which was 627 euros per hectare, while the lowest price for agricultural land in the Republic of Serbia leased in the same year was 9.5 euros per hectare in the municipality of Crna Trava. In the following year, the

maximum lease price of agricultural land is also recorded in the municipality of Temerin, but there is a noticeable mild tendency of price increase compared to the previous year. The lowest purchase price of agricultural land in 2014 was recorded in Babušnica municipality, which was 7.9 euros per hectare. After a slighttrend of the increasinglease price of agricultural land in the Republic of Serbia, in 2015 there was a reverse tendency. The maximum lease price of agricultural land recorded in the municipality of Inđija was 597 euros per hectare, while the minimum lease price for agricultural land was 8.4 euros per hectare and it was recorded in Svrljig municipality. Once again in the municipality of Inđija, in 2016 the highest purchase price of agricultural land of 581 euros per hectare was recorded. The same year, the minimum lease price was recorded in the municipality of Pirot, amounting to 4.1 euros per hectare. Even at the end of the observed period, in 2017, the declining trend continues. The lowest lease price was recorded again in the municipality of Pirot, it being slightly lower than in the previous year, while the maximum lease price was recorded in the municipality of Irig, in the amount of 377 euros per hectare.

The Anti-Corruption Council has published a Report on Privatization and disposability of agricultural land in the public property of the Republic of Serbia in which the leasing of state-owned agricultural land in the period 2013-2017 was analyzed in detail at the level of local administrations. The Council's report shows some alarming facts. Namely, the state offered to lease 180-423 hectares of land hectares. This means that in the years when less than 423 thousand hectares were needed, the state did not lease 800 thousand hectares in total for 5 years, assuming that these 423 thousand hectares arethe total state-owned agricultural land. The land that had beenoffered but not leased has been illegally processed and income has been collected without any legal sanctions. Also, according to the Council's Report, the state loses about 40 million euros a year on unleased land, given the fact that this land is leased for an average price of 202 euros per hectare. If we add the losses based on price disbalances to the equation, it shows that the state has lost a total of around 860 million euros in 5 years. The question is why the state is ready to give up revenues from basically the most valuable and non-renewable resource in public ownership (Lovre, 2018).

Conclusion

The opportunity for development of the domestic agrarian sector lays in relatively favorable agro-ecological conditions and relatively good availability of natural resources, above all, agricultural land. Unfortunately, agricultural land has been

irrationally used for decades, which is confirmed by the presence of a large number of small agricultural holdings. Starting from this fact, a conclusion is reached that without adequate measures of agrarian policy, which will influence the improvement of the ownership land structure; there will be no adequate development of the domestic agricultural sector.

The land market, above all, depends on the long-term elasticity of supply and demand for agro-food products. On the world market there are extensive acquisitions of agricultural land both in developed and underdeveloped countries. The main investors are developing countries and developed countries.

Considering that the prices of agricultural land in the Republic of Serbia are far lower in comparison to the prices in the developed countries, a large number of foreign investors are interested in the Serbian land. The fragmentation of the land parcels and the inability to consolidate the plot due to the existence of a large number of owners is a big obstacle for big investors. That is why only a few large investments were realized, mainly for the purchase of large farms that already had plots of large areas.

By adopting regulations organizing the management, use and protection of agricultural land, the Republic of Serbia has fulfilled the role of the protector of one of the vital resources of the society. Namely, the Law on Agricultural Land prescribes various measures aimed towards preserving the quality of agricultural land. However, in order to implement the policy of conservation of agricultural land in real terms, it is necessary to introduce mechanisms for protecting land from devastation, non-processing and prevention of changes in purpose of agricultural land.

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LEMON BALM (*Melissa officinalis* L.) – TECHNOLOGY OF CULTIVATION AND PRODUCTION COST ESTIMATE[1]

Vladimir Filipović[2], Vladan Ugrenović[3]

Abstract

The demand for lemon balm (Melissa officinalis L.) is growing with years, is it dried leaves (Melissae folium), the above-ground parts (Melissae herba) or lemon balm essential oil (Melissae aetheroleum). The reasons for the increase in the demand lie in the fact that lemon balm is one of the few plants that are simultaneously medicinal, decorative, spice, aromatic and honey plants, and they have industrial application. The demand for the raw material, semi-finished products and final products from lemon balm lies in the fact that the lemon balm raw material from our area is of exceptional quality, and meets the criteria prescribed by appropriate documents for this particular field. As there continues to be self-sown lemon balm, some people still continue to acquire it from nature. The percentage of those who acquire lemon balm from nature is almost negligible. The bulk of the raw material is obtained from cultivated plants. In this regard, in the case of perennial species, it is necessary to follow the guidelines concerning the good practice of lemon balm production and the methods used to improve the existing cultivation technology. This paper represents the author's knowledge on the technology of lemon balm production, its use and the cost estimate showing the investments made in the process of its cultivation.

Key words: *lemon balm, Melissa officinalis L., production, use, production cost estimate.*

Introduction

Lemon balm or common balm, melissa plant, bee balm, balm mint and sweet balm (*Mellisa officinalis* L.) is a perennial herbaceous plant belonging to the mint or

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2 Vladimir Filipović, Ph.D., Senior Research Associate, Institute for Medicinal Plants Research *"Dr Josif Pančić"*, Tadeuša Košćuška no. 1, 11000 Belgrade, Serbia, Phone: +381 13 377 855, E-mail: vfilipovic@mocbilja.rs

3 Vladan Ugrenović, Ph.D., Research Associate, AES Institute *"Tamiš"*, Novoseljanski put no. 33, 26000 Pančevo, Serbia, Phone: +381 13 313 092, E-mail: vladan.ugrenovic@gmail.com

deadnettle family (Lamiaceae). The lemon balm plant was particularly appreciated by the French herbalist Maurice Mességué. According to him, this plant is the queen of all stimulating plants. According to him, lemon balm helps "an unhandy lover, the troubled head of the family, the women who are burdened with problems, the desperate ones and those who are haunted by the sense of defeat in life. I recommend this magical plant that regenerates the body, and restores strength and the joy of living." Lemon balm is one of the few plants that are medicinal, fragrant, decorative, spice, aromatic and honey plants at the same time, and they also have industrial application. In the last few years it has been extremely demanded as a raw material for the production of essential oils, but also as fresh material (for preparing ice teas and cocktails) and dry material (for the production of monocomponent teas and tea blends).

Chemical composition and use. For medicinal purposes, the following are used: (1) dried leaves (*Melissae folium*), (2) the above-ground parts of lemon balm (*Melissae herba*), as well as (3) lemon balm essential oil (*Melissae aetheroleum*). The leaf of lemon balm is used in medicine as a tranquiliser, whereas its essential oil is used in the cosmetic and chemical industry, pharmacy, and for the flavouring of beverages and some food products. It is most often utilised in case of the disorders of digestive organs, acts as a mild tranquiliser, and helps with sleep disorder. In the form of extracts rich in rosemaryric acid, it is used externally in herpes virus infections. Lemon balm has been used for more than 3,000 years in Tibetan medicine as a bioactive plant for the treatment of psychological problems. Today, the effects of the oral use of lemon balm preparations are the subject of numerous studies and various sorts of research, which deal with its effects on anxiety, insomnia, depression, dyspepsia, vomiting, flatulence, attention deficit and hyperactivity disorder (ADHD), dysmenorrhea, cramps, headache, toothache, infections, tumors, insect stings, Alzheimer's disease, tranquility, melancholy, palpitations, rheumatism and high blood pressure. The German Commission E approves the use of lemon balm for the treatment of nervous sleep disorders and functional disorders of the gastrointestinal tract.

In keeping with the World Health Organization guidelines in the WHO monograph *Monographs on Selected Medicinal Plants – Volume 2* of 2004 (WHO, 2004), the *Melissae folium* drug is used externally for the symptomatic treatment of herpes labialis, or, commonly known as cold sores, it actually arises as the consequent reaction to coming in contact with the herpes virus. It is used as a carminative (an agent that relieves gastrointestinal problems) for gastrointestinal disorders, as well

as a sedative (a substance that has a calming psychological effect) for the treatment of nervous sleep disorders.

Traditional European medicine includes the use of lemon balm as a calming tea for calming, for the treatment of migraine, toothache, headache and high blood pressure. In phytotherapy, lemon balm is known for its carminative, gastric, sedating, antiseptic, antiviral, antimicrobial, and antioxidant properties.

Lemon balm is also a honey plant, and bees love it, so, because of that, it bears the name of lemon balm. Blooming can last from the end of May to mid September (Bekić et al., 2014). Lemon balm blossoms have an average lifespan of one day. The best bloom is in the morning. The most common polynators on lemon balm blossoms are bees and bumblebees, which represent primary polynators (Božek, 2000; Chwil, 2009). Lemon balm essential oil is highly appreciated, and has a high price in the perfume and cosmetics industry. Large quantities of lemon balm essential oil are used in the concentrate and flavour industry and in the liquor industry (e.g. the beverages Benediktin and Shartrez). Lemon balm essential oil has an extremely strong antimicrobial activity, and, as such, could have more application in various spheres of human life (Grujić-Jovanović et al., 2003; Aničić et al., 2005; Jovanović et al., 2016). In this connection, the interest in the cultivation of lemon balm and the purchase of its seeds has increased to a great extent, primarily for the purpose of obtaining the mass for the distillation of essential oil. For the lemon balm variety by the name of "Citron", which is produced and sold at the Institute for Medicinal Plants Research "Dr Josif Pančić" from Belgrade under favorable conditions of growing, two mowings are performed in a single year (Filipović, 2018). It yields from 4,000 to 6,000 kg/ha for the above-ground parts (herba), about 2,000 kg/ha of dry leaves and 3 to 4 kg/ha of essential oil.

Morphological characteristics. Lemon balm is a perennial herbaceous plant that reaches a height of up to 100 cm, with a highly developed and strong root. The underground spawns, which are large in number, develop horizontally, and new mother trunk emerges from them. The above-ground part trunk is very branchy, and it is foursquare at the cross-section. Its leaves are like nettle leaves: egg- and heart-shaped, jagged-edged on the periphery, slightly hairy, greenish and yellowish in colour. They are oppositely arranged on long leaf pedicels. There are glands on a leaf. The leaf contains 0.1–0.3% of essential oil, vitamins and bitter substances. The essential oil of lemon balm is obtained by distilling the leaves and herbs by the means of water vapor. The main ingredients of essential oil are: citral (geranial –

citral A and neral – citral B), citronellal, linalol, geraniol and β-carfylene oxide. Due to the presence of citruses (about 11%), the whole plant has a pleasant lemon-like smell, and is covered with small and fine hairs. The essential oil of lemon balm also has the smell of lemon. Because of this, it is commony called lemon grass. The flowers are white to reddish, up to 1.5 cm in length, in groups of 6–10, located in spleen blooms, in the armpit of the upper leaves. It blooms from June to August. The seeds are small, glossy and dark, egg-shaped. The weight of 1,000 seeds is about 0.6 g. The germination of the seed is 85-90% and decreases with the seed age.

Agroecological conditions. According to its breeding region within the Republic of Serbia, lemon balm is grown in both production regions: the lowland one (Vojvodina) and the mountainous one (Central Serbia), (Filipović, Popović, 2014). Lemon balm grows in quite a variety of climatic conditions. As a wild flower, the plant grows throughout Europe, except in the extreme north and south. It can be grown everywhere in our region, but only up to 1,000 m above sea level. It grows best in the areas with an average rainfall of 600 mm. Due to the tendency of lemon balm to suffer from some leaf diseases, the positions with good air circulation are recommended. Shady or semi-shade surfaces should be avoided, as they affect the reduction of ethereal oil content. Lemon balm is resistant to low temperatures, so in our agroecological conditions, there is no danger of freezing during winter.

Fertile soils are beneficial for lemon balm. Moderately wet, loose and humus-rich soils, with poorly acidic to neutral pH reaction, are suitable for its ciultivation. Heavy and wet soils should be avoided.

Production technology

Crop rotation. As a perennial species, lemon balm does not enter the classic crop rotation, because it can remain in the same place for up to ten years. For pre-crops, it is necessary to use species that leave the soil unweeded, because weeds are a major problem in lemon balm seedlings when harvesting. Regarding the previous crop, lemon balm does not set any specific requirements. Since lemon balm is planted in the autumn, every pre-crop that is early removed from the plot is good for it. Therefore, it can come in a crop rotation following stubble cereals, row crops and industrial plants. It is also successfully grown on ploughed natural meadows and pastures, with good soil preparation and adequate fertilisation. However, the best results in the production practice are achieved on those plots on which the pre-crop has been fertilised with burnt manure. Lemon balm is a

suitable pre-crop for most medicinal and field crop species, except for the representatives of the mint or deadnettle family (Lamiaceae). It populates the same place again only four or five years later.

Soil tillage systems. Basic processing depends on pre-crops. In the case of stubble cereals or some plant species that leaves the field early, it is shallow-ploughed immediately after the harvest, at 10 to 15 cm depth. At the end of September or in October, it is ploughed full depth, which should not be less than 30–35 cm, because this perennial species stays in the same place for several years. If the crops are formed on leas (meadows), shallow ploughing sets off as early as the early summer, and is repeated several times. By this method, the weeds are almost completely destroyed, particularly those perennial ones, which are extremely undesirable in a plantation of lemon balm (creeping thistle, Johnsongrass, Quackgrass, Bermuda grass). Light soils are ploughed to a somewhat smaller depth (22–25 cm). However, on extremely light soils, soil cultivation is necessary to be performed in the spring, when sowing or the planting of seedlings is planned. All actions, as well as terrain alignment, should be carried out by the end of October at the latest if lemon balm is planted in autumn. Planting preparation is done just before the planting of lemon balm, and above all, it should provide a loose surface layer up to 15 cm deep. This will create better conditions for root development.

Fertilisation with organic and mineral nutrients. Lemon balm gives the best yield if it is grown on a plot that was fertilised with manure the year before. For the basic mineral nutrition, it is organic fertilisers that are mainly utilised, such as manure and compost, and one of the compostable plants is also lemon balm itself. The total above-ground part biomass (without gathered leaves) represents compostable leftovers, which, depending on weather conditions, amounts to 12 to 15 t/ha on average, which makes up about 50% of the total mass that occurs in the processing of lemon balm leaf (Filipović, Ugrenović, 2013). For the production of lemon balm, certain mineral fertilisers are used in the amount of about 160–180 kg/ha of nitrogen, 60–70 kg/ha of phosphorus and 180–200 kg/ha of potassium. These quantities should be corrected depending on the results of soil fertility control. The basic treatment applies the total amount of phosphorus and potassium and 30% of nitrogen, whereas the rest of 70% nitrogen is applied in pre-sowing soil preparation. In the spring, supplementation is done with 60–70 kg/ha of nitrogen. Lemon balm responds well to foliar fertilisers, too.

Different types of basic mineral fertilisers can be applied in lemon balm plantations (NPK (15:15:15), DAP, MAP, MKP and other commercial fertilisers). To the listed fertilisers, "supplements", mainly nitrogenous ones, are added, such as: K_2SO_4 (potassium sulphate) or NH_4NO_3 (ammonium nitrate). One of more suitable fertilisers (52% of P_2O_5 and 34% of K_2O), or so-called Monopotassium Phosphate (Tepecik et al., 2016). In terms of essential oil contents, it has been found that the application of MKP affords significantly more essential oil compared to the use of other commercial fertilisers. The highest content of the essential oil component, such as: gerenial, neral, citronellal and β-caryophyllene.

The assortment. There are a large number of lemon balm varieties in the world, and they are mostly selected for certain regions of growing. In our country, only the variety called "Citron" has been registered, and is produced and sold at the Institute for Medicinal Plants Research "Dr Josif Pančić" from Belgrade. It is resistant to frosts and drought, it is a good bee pasture and successfully prevents erosion. There are many varieties grown in the world such as: *Aurea*, *Citronella*, *Lemona*, *Lorelei*, *Erfurter Aufrechte*, *Soroksari*, *Gold Leaf*, *Dutch Duck*, *Quedlinburger Niederlegende* and others.

Sowing/planting. For the successful production of lemon balm, it is necessary to properly establish seedling production, which, in the case of this plant, represents the most adequate production technology. The sharing of roots or the use of cuttings, as well as the direct sowing of seeds, do not meet either technological or economic indicators of production. To form one hectare of seedlings, it takes 1.0 to 1.2 kg of lemon balm seeds. The sowing for the production of seedling is carried out in warm and/or cold beds. In practice, almost always, the production of seedlings is applied through cold beds. The soil for the beds is well prepared and aligned. Sowing is done in the period from May to July. The soil on which seedlings will be based is prepared according to tried and tested methods, with previously performed sterilisation. In practice, however, ready-made sterilised substrates are used, enriched with the necessary nutritional macro- and microelements with the appropriate pH value and excellent water-air regimen. These substrates have the advantage over the substrates that can be prepared on one's own. After the application of the substrate, one moves on to the sowing of seedlings. The sowing is done in rows at a distance of 10-15 cm between rows. The rows are formed as shallow furrows, from 0.5 cm to the maximum of 1.0 cm. For seeding of 1 m2, 5-7 g of seed is needed. The seedlins are left in the beds until the autumn, when when they are planted at an inter-row distance of 70 cm, and in the row of 30 cm. As stated in

the section "Agroecological conditions", for this fragrant plant, originating in the Mediterranean, it is best to provide soils exposed to sunlight and rich in humus, low-acid to neutral, with low alkaline reaction. Planting is done at a depth of 6 to 8 cm. Planting is carried out manually (dibble) or mechanically (vegetable planters).

Care measures. Seedling care includes hilling, inter-row cultivation, additional fertilzation, irrigation and possibly, filling empty spaces. Inter-row cultivation and hilling should be done at least two to three times a year. The first hilling is done as soon as the first weeds or epidermis appear, and another 15-20 days after the first ones. Hilling is done by need, i.e. according to the state of weediness on the plot. In practice, the last hilling in a season is performed immediately before mowing. Given that lemon balm is grown because of its above-ground part biomass, the additional fertilzation with nitrogenous fertilisers is of prime importance for yield. It is best to apply nitrogen fertilisers on two occasions. The first feeding is carried out immediately before the first hilling with about 30-35 kg/ha of nitrogen. The second additional fertilzation is done with the same amount after the first mowing. As far as the older seedlings are concerned, they need to be fertilised with 50 to 60 kg/ha of active NPK matter. After this fertilization, some deeper hilling should be carried out in order to "put down" the phosphorus and potassium to the available level of the root system. It is desirable to irrigate lemon balm, primarily because lemon balm is a plant species of humid areas. If there is no possibility of irrigation, the yields will be reduced, as will the number of mowings. When planting seedlings, in order for the plant to start better, it is mandatory to irrigate it before and after planting, as well as in the initial stages of plant starting. As lemon balm is one of the plants for which larger amounts of water are favourable, if possible, it is necessary to irrigate it (Filipovic & Kljajic, 2015). Although in some cases the application of this measure has a slight influence on the decrease in the yield and quality of the raw material obtained (Ozturk et al., 2004). In the Republic of Macedonia, in lemon balm seedlings grown according to organic methods, after each mowing, the seedlings are irrigated with 50 mm of water (Mihajlov et al., 2013). The filling of empty places for lemon balm seedling is of great importance, because for many years it remains on the same soil. This is done until the fourth or fifth year of growing, and only stronger and more developed seedlings are used.

The characteristic disease of lemon balm are lemon balm leaf freckles, caused the appearance of grayish and black spots on the leaves, as well as rust. Lemon balm leaf freckless of the matrix leaf is economically the most important disease in our area. This disease is caused by the fungus *Septoria melissae* Desmazieres. It con-

sists of ubiquitous and annual damage in nursery gardens and old plantations. The first symptoms of the disease appear as early as the spring, and under favorable conditions (high humidity), the presence of leaf freckless increases. The appearance of this disease is noticeable in the form of mostly black or brown spots in the internervous parts of the leaves. The disease develops during most of the season and, in a severe attack, the damaged leaves fall off the tree. In order to suppress its presence, copper, benomyl and potassium bicarbonate based products are used more as a preventive measure, and treatments should begin at the first signs of the disease. During the vegetation period, one can, for example, use the combined systemic and preventive Signum fungicide in the amount of 1.2 kg/ha and the contact preventive fungicide Polyram DF in the amount of 1.8 kg/ha. The lemon balm rust disease (*Puccinia melissae* Pers.), which is mentioned in literature, has not been observed in our country. In literary sources (Stanev, Lambev, 2011) the following are also mentioned: *Phylosticta melissae* Bub., *Cilindrosporium melissae* Massal., *Erysiphe galeopsidis* De et Merat. And very rarely *Sclerotinia sclerotiorum* Lib. The most commonly occuring pests are: Halticinae flea beetles, certain cycadas (*Eupterix atropunktata* Goeze, *E. collina* Flor., *Empoasca flavescens* Fabricius) and shielded hardheads, whose number is usually small, and, as such, does not endanger the survival of the seedling, so it is not necessary to implement their suppression. The twospotted spider mite (*Tetranychus urticae* Koch.) can be found here and there, and they feed on leaves where there may be a phenomenon known as bronze leaf disease. Sporadically, the presence of plant lice can be recorded, whose appearance and number does not endanger the sustainability of seedlings.

Harvest. In order to get high quality drugs, among other things, it is necessary to take into account the time and the method of mowing. Lemon balm is mowed twice a year, and with full agrotechnology and suitable agroecological conditions, this number can be increased. The mowing time depends on the purpose of the raw material, whether the raw material will be used for dry leaf drug or for the production of essential oil. If lemon balm is cut to produce dry leaf drug (*Melissae folium*), it is physiologically mature when the stem reaches a height of about 60 cm, and the ratio of the leaf and stem quantity should be 60:40%. In our production conditions, the percentage of dry leaf and stems in dry overhead mass (herba) is approximately 70:30% on average for five-year-old seedlings (Stepanović, Vukomanović, 1991). Lemon balm is mowed before blossoms appear on the plant (Saeb, Gholamrezaee, 2012). At that time, the leaves are the largest, and that is when it has the highest essential oil content, which is the best quality in that period. In the conditions of dry farming, two swaths are achieved, and with a regular distribution of precipitation,

sometimes, there even occurs a third, somewhat scarcer swath. If seedlings are irrigated, it can give three, sometimes four, swaths annually. The most frequent is the first crop in the first half of June and the second one during the month of August/ September, which depends on external conditions. In the case of older seedlings, it often happens that the beginning of mowing takes place as early as mid-May.

It frequently occurs that, if mowing is done for the purpose of obtaining essential oil (*Melissae aetheroleum*), the mowing takes place a month later in relation to the mowing for the production dry leaf drug (*Melissae folium*). The main components that can be found in the leaf of lemon balm are neral, geranial, and citronellal. Under the conditions of the research organised at our Institute for the Institute for Medicinal Plants Research "Dr Josif Pančić" in Pančevo, the average content of essential oil in the lemon balm leaf was 0.16% (Stepanović, Vukomanović, 1991). After the first mowing in the phase prior to the beginning of blooming, on average, 0.08% of essential oil was obtained, in the second mowing, i.e., in the bloom stage, the content of essential oil was 0.19%, and in the third mowing in the stage following the blooming – the stage of seed production, 0.26% of essential oil was recorded. As for the age of seedlings, the highest content of essential oil was in the fourth year, and the smallest content of essential oil was in the third year of growing.

Their presence makes the lemon balm smell like lemon. Their content is higher in earlier stages of vegetation (Kitzler, 2008). In practice, for this purpose, this term of mowing is more common than mowing for the needs of distillation of essential oil in the phase before flowers appear on the plant. According to Singh et al. (2014), the highest percentage of essential oil in the above-ground part of the lemon balm in the first year of the plant is at the moment after 160 days of planting. If the first digestion is used for distillation, intensive irrigation is not recommended, because the content of essential oil in the plant is reduced, and after the first cut in the third decade of July, it can be counted with just another crack at the beginning of October, for obtaining a dry leaf drug (*Melissae folium*).

Mowing is done in a quiet, beautiful and sunny time when there is no longer rose. It is cut at a height of 5 to 10 cm above the ground. Low mowing stimulates the emergence of a large number of shoots for the next mowing. In the case of smaller surfaces, manual mowing is carried out with sickle or hair. Machine mowing can be done in several ways: a self-harvesting combine harvester, a chamomile combine with the pickup mechanism replaced by a grain cutter or a tractor side piece. It only needs to mow as much as it can accumulate, because the mass of the mass

that remains outside overnight is no longer for use because it is completely dark. The above-ground part mass must not be compressed and crushed but must be taken to dry in a loose state.

Drying. The lemon balm can be dried naturally, in a protected breathable area or in baskets, if it is a minor production. If it is not immediately put on the drying leaves, the matrix quickly loses dew and its quality decreases if it dries naturally, then it must be in a thin layer (up to 2 cm high layer). Drying can also be done in thermal dryers, at a temperature of up to 40 °C. In this part, special attention should be paid to the drying temperature, which should not exceed 40 °C, because at a higher temperature the essential oil is evaporated, and such a lemon balm is of no value as it loses its smell and healing properties. Dried leaves must be green in color, without any admixture, pleasant smell on lemon and must not be crushed. The relationship between fresh and dry above-ground part mass is 4: 1.

In order to get the right drug *Melissae folium* it is necessary that the leaves of the matrix be separated from the stem. In the past, today a smaller number of producers are separating the leaf from the stem before drying. More recently, the separation of the leaves from the stem (whether fresh or in dry condition) is carried out on specially designed machines for this purpose.

Yield. In the first year of production, fresh above-ground part weights can be obtained in the amount of 5-8,000 kg/ha or 1,500-2,000 kg/ha of dry herba. Regarding dry leaves, in the first year, the yield of dry leaves amounts to 700-1,000 kg/ha. In the following years, the yield of fresh above-ground part weight would range 12-15,000 kg/ha, or of dry herba 4,500-6,000 kg/ha. The dry leaf yield would be 2.500-3.000 kg/ha. If irrigation is applied, the yield increases by 30-40%. The yield of essential oil from the surface area unit is low, and the content of the active substances varies depends on the characteristics of the variety, the characteristics of the climate and the soil, the applied agro-technology, etc. The content of essential oil in the *Melissae folium* drug is 0.01-0.35% in relation to dry matter. The calculated yield of essential oil from fresh above-ground part mass varies from 8 to 12 kg/ha.

Packaging and storage. The best way to pack the lemon balm leaves is in cardboard boxes coated with dark paper, making sure that the leaf is not crushed. Thus, essential oil is best preserved. A good quality leaf should preserve natural green colour. The pleasant lemon-like smell is the basis of the good quality of lemon balm

leaves. A good way to pack is to press it into 50 kg bundles. This method is most often used if lemon balm is prepared for export. It can also be packaged in paper bags, but it must be ensured that the leaves do not crush. Dried and packed lemon balm is kept in clean ventilated warehouses on wooden stands or on pallets, taking care that the height of the arranged goods does not exceed 2 m. It is kept in a cool, dry and airy place. It is important not to store it with other aromatic drugs, because it will take their smells. The arranged goods in the warehouse must be kept from the presence of harmful insects and rodents.

Quality for lemon balm leaf. Regarding the quality norms, it is important that the lemon balm leaf keeps the natural green color and that it preserves the smell. The Yugoslav Institute for Standardization prescribed JUSE.B3-062 for the *Melissae folium* drug:

Criteria	**Class I**	**Class II**
essential oil – at least	0.1	0.05
chopped leaves that can go through a sieve hole of 2 mm – at the most	3	10
leaves with changed colour – at the most	4	8
other parts of the plant (peaks) – at the most	3	5
trunk parts – at the most	2	5
organic impurities (plant impurities) – at the most	-	1
non organic dirth, at the most	0,5	1
moisture – 12% at the most		
ash – 12% at the most		

On the other hand, the required quality standard Ph. Eur. 7 for the lemon balm leaf (*Melissae folium*) according to the European Pharmacopoeia (Ph Eur 7.0., 2011) is that the dry lemon balm leaf contains the total hydroxy-amino derivatives expressed as rosmarinic acid (C18H1608, Mr = 360.3) at a minimum 1.0 per cent (dried drug). Foreign matter: Trunks size greater than 1 mm max. Max. 10%; Other foreign matter 2%; loss by drying: max. 10.0% and total ash, max. 12.0%. According to the World Health Organization guidelines in the WHO Monographs on Selected Medicinal Plants - Volume 2 of 2004 (WHO, 2004) for the drug of *Melissae folium*, it is prescribed that, in addition to drug testing, the presence of specific microorganisms, pesticide residues and heavy metals, determine the presence of other foreign matter, loss of drying and total ashes for which the values from the aforementioned European Pharmacopoeia are prescribed (Ph Eur 7.0., 2011).

Cost-benefit analysis of lemon balm. In the following section are given Tables 1-3, which show the indicative cost benefit analysis of production of lemon balm leaf, designed for an area of one hectare.

Table 1. *Cost benefit analysis of lemon balm leaf production in the first year of cultivation, for an area of 1 ha*

Variable production costs	(€)
Mineral fertilization: starting and in the supplemental feeding	400
Preparations for plant protection	40
Manure	225
Seed	110
Ploughing to 30 cm	90
Application of mineral fertilizers 2x	26
Loading manure	15
Exporting and spreading manure	30
Harrowing (disking)	20
Presowing treatment	20
Seedling production	380
Watering	80
Seedling planting	28
Inter-row cultivation 2x	35
Tretmant with preparations for plant protection	25
Moving (2x in vegetation season)	40
Transport to dryer	60
Seasonal working labor	850
Drying	120
Total costs (T)	**2.594**
Income	
Leaf yield (600 kg) x price 2,8 (€) (P)	**1.680**
Total income	
Profit (P – T)	**-914**

Note: *The middle exchange rate of NBS on: October 22, 2018. it was 118.9350 dinars for 1.0 euros (Euro). Mechanical services are given on the basis of the price list of the Cooperative Association of Vojvodina for 2017. Part of the data presented was obtained from the production part of the Institute for Medicinal Plant Research "Dr Josif Pančić" from Belgrade, located in Pančevo.*

Table 2. *Cost benefit analysis of lemon balm leaf production in the second year of cultivation, for an area of 1 ha*

Variable production costs	(€)
Mineral and foliar fertilization	160
Preparations for plant protection	40
Application of mineral fertilizers 2x	26
Inter-row cultivation 2x	35
Tretmant with preparations for plant protection	25
Moving (2x in vegetation season)	40
Transport to dryer	120
Seasonal working labor	510
Drying	400
Total costs (T)	**1356**
Income	
Leaf yield (2000 kg) x price 2,8 (€) (P)	**5.600**
Total income	
Profit (P – T)	**4.244**

Note: *The middle exchange rate of NBS on: October 22, 2018. it was 118.9350 dinars for 1.0 euros (Euro). Mechanical services are given on the basis of the price list of the Cooperative Association of Vojvodina for 2017. Part of the data presented was obtained from the production part of the Institute for Medicinal Plant Research "Dr Josif Pančić" from Belgrade, located in Pančevo.*

The cost statement for the production of lemon balm leaf in the first year of growing on an area of one hectare is shown in Table 1. The profit is -914 €, that is, it was not realised. Since the yield of lemon balm leaf increases from year to year, the profit is also increased. The profit in the second year of the growing of lemon balm amounted to 4,244 € (Table 2), whereas in the third year, it amounted to 5,414 € (Table 3). In this regard, as in our agro-ecological conditions the seedlings of lemon balm are maintained on the average of four to five years, for the sake of maters, for an average of four to five years, from what is shown here, one can see how much achieved profit can be expected. Accordingly, it can be noted that this production is beneficial or profitable.

Table 3. *Cost benefit analysis of lemon balm leaf production in the third and other years of cultivation, for an area of 1 ha*

Variable production costs	(€)
Mineral and foliar fertilization	240
Preparations for plant protection	40
Application of mineral fertilizers 2x	26
Inter-row cultivation 2x	35
Tretmant with preparations for plant protection	25
Moving (2x in vegetation season)	40
Transport to dryer	120
Seasonal working labor	560
Drying	500
Total costs (T)	**1.586**
Income	
Leaf yield (2500 kg) x price 2,8 (€) (P)	**7.000**
Total income	
Profit (P – T)	**5.414**

Note: *The middle exchange rate of NBS on: October 22, 2018. it was 118.9350 dinars for 1.0 euros (Euro). Mechanical services are given on the basis of the price list of the Cooperative Association of Vojvodina for 2017. Part of the data presented was obtained from the production part of the Institute for Medicinal Plant Research "Dr Josif Pančić" from Belgrade, located in Pančevo.*

Conclusion

As stated, in our country ranging from agroecological, human and technological conditions, there are favorable conditions for successful production of leaf, aboveground part mass and essential oil of lemon balm. However, the insufficiently stable market for this type of raw materials (one year of demand is high, next year is small), as well as the lack of workforce in the countryside, reluctance and rapid abandonment of growing, greatly "endanger" the production of lemon balm as a species that can satisfy domestic and export needs. It seems that, even though we possess appropriate agroecological and technological conditions, the human factor, the technical and organisational one in particular, as well as that with the provision of unskilled workforce, make the current production of lemon balm at a low level, which is in contrast to the fact that the production of lemon balm leaf, but also of its essential oil, is more profitable compared to a large number of types

production in some other branches of agriculture. The wide use and the possibility of developing new, as well as a large number of official and traditional preparations, make it possible to increase the area under the grown lemon balm.

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THE QUALITY OF SUPPLY CHAIN ARRANGEMENTS AND WHEAT FARMING SUSTAINABILITY IN SERBIA

Žaklina Stojanović[1], Bojan Ristić[2]

Abstract

Strong negotiating power of upstream and downstream sectors over farmers in the supply chain are often nominated as important factors that negatively affect farming sustainability in the long run. The paper objectives are to map existing institutional arrangements in the wheat sector in the Region of Vojvodina (Serbia). Additionally, the research explores the sustainability through producers' opinions regarding quality of institutional arrangements and its role in achieving sustainable farm businesses including collection of information on the adoption of good environmental practices. The analysis generally explains the drivers of change and possible set of future farmers' strategies aiming to improve their position within supply chain. Sustainability is observed using the triple bottom line as unity of economic, social and environmental goals. Additionally, the research shed light on market failures and protection policy directed toward prevention from unfair trading practices in Serbia.

Key words: *wheat, supply chain, institutional arrangements, sustainability, strategies.*

Introduction

From the theoretical point of view, modernisation in agricultural sector has contributed to a sort of bimodal transformation - reduction in farm numbers is usually followed by capital concentration. However, community-based coordination mechanisms has led to further sector development by creating a new form of institutional arrangements that more intensively include different aspects of farms sustainability (Renting, Van der Ploeg, 2001). Institutional arrangements are also seen as important factor of overcoming market failures as well (Eaton

1 Žaklina Stojanović, Ph.D., Full Professor, University of Belgrade, Faculty of Economics, Kamenička Street no. 6, 11000 Belgrade, Serbia, Phone: +381 11 3021 162, E-mail: zaklina@ekof.bg.ac.rs

2 Bojan Ristić, Ph.D., Assistant Professor, University of Belgrade, Faulty of Economics, Kamenička Street no. 6, 11000 Belgrade, Serbia, Phone: + 381 11 3021 049, E-mail: bristic@ekof.bg.ac.rs

et al., 2007). Basically, there are four level systems of institutions that describe overall quality of arrangements set among stakeholders (Williamson, 2000). First level is linked with complementary institutions - formal and informal (so-called the social embedded-ness level). The institutional environment is recognized as the second level and refers to formal rules implemented in the sector. The governance of contractual relations are in the focus of the third level, while ex ante incentive alignment and efficient risk bearing belong to the final - fourth level. If the system is described mostly using different formal-informal relations, economizing is less possible and system is less efficient.

Because of the historical, but also environmental and social factors, agriculture in Vojvodina significantly differs from agriculture in the central part of Serbia. The average farm size is quite larger; the agriculture is more specialized and based mostly on crop production. This region is generally more open to agricultural innovations than the rest of Serbia. The objectives of this paper are to map existing institutional arrangements across in the Region of Vojvodina in the wheat sector and to identify the main attributes characterizing institutional arrangements. Having in mind previously mentioned, this paper explores sustainability of farms practices in the region through producers' opinions regarding quality of institutional arrangements and its role in achieving sustainable farm businesses (in economic, social and environmental context). The research explores the extent to which some institutional arrangements are more likely to be adopted by certain farmers groups, based on the key socio-demographic characteristics of farms.

It is also important to stress that the food chain stakeholders' attitudes towards farms sustainability were explored using qualitative research techniques during the preliminary phase of the research. Two focus groups discussions were conducted in May 2017. Additionally, all obtained results were tested during discussion with food chain stakeholders in the form of participant workshop (participatory approach). The understanding of sustainability in the region is connected with the environmental point of view - our farmers usually emphasize importance of different sustainability aspects such as biodiversity, use of chemicals and the importance of four-course system in crop production. However, producers mainly link sustainability with economic conditions such as wheat price, price volatility, production cost and input-output parity. The identified approach reflects certain "traditionalism". Our experts pointed out also that farmers less than 40 years old might have a different approach. According to the experts opinion farmers think about economic part of their business mostly, while social or environmental aspects are less important for them.

The analysis is based on farms performance in 2016/17 (production, average price for the commodity, self-perceived efficiency etc.). Sales channels are observed either as collective (cooperatives, POs and unions) or individual (wholesalers, retailers, exporters, local shop and markets, restaurants or processors). Different characteristics of dominant institutional arrangements (the main sale channels) are further observed by asking more specific questions about characteristics related to formal or informal sale contracts, duration of contract arrangements, involvement of different criteria for price definition, payments and standards involved etc. Farmers were also asked to mark overall quality of sale arrangements, particularly on the context of achieving sustainable farm practices.

The research method and sample

The exploratory producers' survey is based on structured questionnaire (qualitative research insights was previously obtained by the focus groups discussions in 11 European countries). A random selection of the sample units is based on two main levels of stratification: the district level in the Region of Vojvodina, and farm size. The analysis is focused on young farmers (less than 40 years) and farms above 20 ha of agricultural area of wheat as the additional criteria. The sampling frame, i.e. the list of primary producers is obtained using the Census data (2012). The sample of primary producers in the region for study is representative for the targeted population. The data collection was supported by the agricultural extension service in the Region of Vojvodina. The interviewing procedure was based on the H2020 SAUFISA guidelines[3]. The interviews were conducted in December 2017 / January 2018. The interviews were lasting on average 35 minutes and conducted using the face-to-face method. The sample size is 140.

Table 1. *The interviewed farms characteristics & farm size*

Characteristics	< 2 ha	2 to 10 ha	10 to 50 ha	50 to 250 ha	> 250 ha
Wheat_Total_Area					
Total_area_av	-	5.60	23.59	102.91	612.50
Comm_area_av	-	2.24	8.08	35.53	181.67
Comm_income_av	-	1138	7700	32486	198860
Comm_price_av	-	0.139	0.160	0.146	0.143

3 The material that lies at the basis of this paper was collected during the European research project H2020 SUFISA. This project has received funds from the EU's Horizon 2020 research and innovation programme under Grant Agreement No 635577.

Characteristics	< 2 ha	2 to 10 ha	10 to 50 ha	50 to 250 ha	> 250 ha
Cost_share_(%)	-	79.50	78.73	75.36	74.17
Comm_sold_(%)	-	72.00	77.69	87.15	87.50
Coll_channel	-	11	41	46	3
Ind_channel	-	12	19	16	9
Total_no	-	20	52	56	12
Age_av	-	45.90	46.25	47.69	44.25
Wheat_Comm_Area					
Total_area_av	7.44	18.84	70.89	244.60	1380.00
Comm_area_av	1.12	4.52	22.22	74.35	510.00
Comm_price_av	0.142	0.142	0.158	0.144	0.143
Cost_share_(%)	70.63	79.30	77.23	75.00	71.67
Comm_sold_(%)	73.75	72.73	86.89	84.75	90.00
Coll_channel	5	32	53	12	0
Ind_channel	3	19	17	14	3
Total_no	8	44	20	20	3
Age_av	44.88	47.48	47.05	45.45	41.67

Source: *SUFISA farms survey (RS – wheat)*

The larger farms dominate in our sample (the smallest number of farms belongs to the group of less than 10 ha of total area). Young farmers represent a slightly more than one third of our sample. On average, the youngest farmers belong to the group of the largest farms (44.25 years based on total area and 41.67 based on wheat area on average). Higher educated farmers manage the largest farms on average (around 260 ha in total and 93 ha in wheat area). Traditional gender structure is manifested by larger share of male farmers, while the share of lower secondary education level among farmers is almost 70%. Self-reported income is calculated using data on average price and quantity sold per farm during the observed period. The average income per farm is 33,418 euro (based only on wheat production). The information about the cost of wheat production is collected as well, and the average share of cost in total income collected only in the wheat production is 76.5% (self-reported).

Based on the data of total area of the surveyed farms, both rented and owned, and also area used for wheat (Table 1), as expected, the higher average income in total is generated on farms of larger size. However, it is interesting to notice that the average wheat price is higher for the group of farms from 10 to 50 ha in comparison with other firm size groups (both in total and wheat area). In addition, collective sales channel dominates the individual in all firm size groups except

for farms above 250 ha. However, the youngest farmers on average belong to the group of the largest farms (44.25 years based on total area and 41.67 based on wheat area on average).

Concerning the age of farm owners/managers (see Table 2), the highest number of farms (n=48) is in the age range under 40 years with an average age of 34.59, while the group of older farmers (>65 years) with an average age of 68 years consists only of 7 interviewed farmers. The total wheat income generated is highest for the group of farmers under 40 years, while farmers from 50-65 years old are capable to achieve the best price of wheat at the market. However, the highest share of cost in generated farm income is reported in this group as well, referring to implementation of old technology or absence of innovations. Implementation of low input technologies also appears in the oldest group of interviewed farmers.

Table 2. *The interviewed farms characteristics & age structure*

Wheat_age	<40	40-50	50-65	>65
Total_area_av	138.88	103.22	74.14	47.57
Comm_area_av	45.88	37.04	18.77	16.14
Comm_income_av	46434	36306	19057	16064
Comm_price_av	0.141	0.145	0.165	0.145
Cost_share_(%)	76.67	74.00	81.48	69.29
Comm_sold_(%)	83.78	81.00	79.27	81.43
Coll_channel	28	34	34	7
Ind_channel	21	15	17	3
Total_no	48	40	44	7
Age_av	34.59	46.10	57.16	68.00

Source: *SUFISA farms survey (RS – wheat)*

As far as farmers education is concerned, higher educated farmers manage the largest farms on average (around 260 ha in total and 93 ha in wheat area). The highest number of collective arrangements is present in the group of lower secondary educated farmers (n=71), while higher secondary educated farmers report the highest share of collective arrangements in total number of arrangements. The individual arrangements are overrepresented in the group of higher educated farmers with traders/exporters as the main counterpart. Relative importance of individual sales is higher also for the group of primary educated, oldest farmers who decide to sell their products at the local markets.

The research results - collective and individual sales arrangements

As far as sales frequency related to collective (Coll) and individual (Ind) sales channels in the wheat sector are concerned, results are n=99 for collective and n=41 for individual. Notably, there are four types of wheat producers in the Republic of Serbia – individual producers (family-owned farms), agricultural holdings, agricultural companies and agricultural cooperatives. However, small family-owned farms dominate the total number of producers. The fact is that farms with more than 20 ha represent only 3% of the total number of farms. So, the orientation of small producers towards collective sales channels and still existing trust in them is inherited from the socialist era. Large producers mainly sell directly to the wholesalers or exporters. Concerning collective and individual arrangements in general, characteristics of farmers in our sample are presented in Table 3.

Table 3. *Collective and Individual sales arrangements*

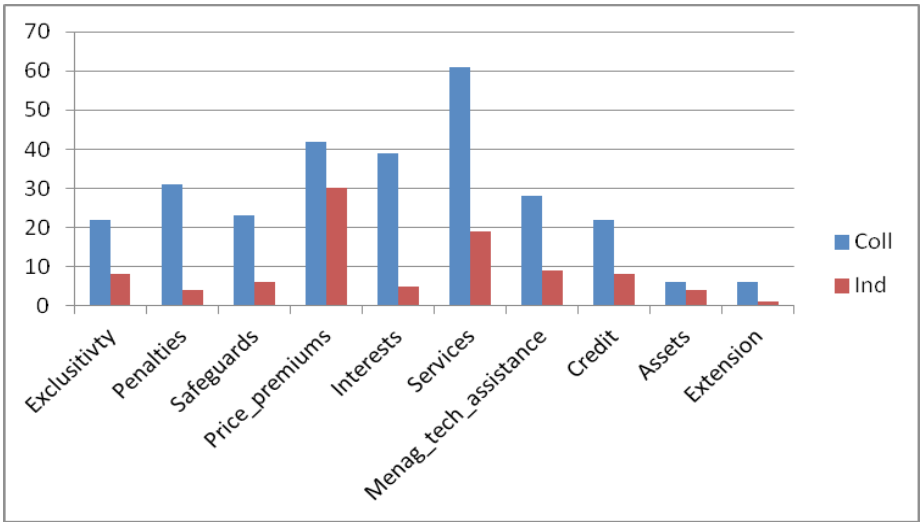
Wheat_sale_channel	Coll	Ind
Total_area_av	63.09	202.02
Comm_area_av	19.69	66.32
Comm_income_av	17511	71827
Comm_price_av	0.143	0.166
Cost_share_(%)	176.51	78.90
Comm_sold_(%)	82.91	77.93
Total_no	99	41
Age_av	46.00	43.95

Source: *SUFISA farms survey (RS – wheat)*

Figure 1. depicts primary characteristics of collective and individual sale arrangements. In relative terms needed exclusivity of sales (Exclusivity) and primary producers crediting (Credit) and eventually, managerial support or technical assistance they receive from buyers (Menag_tech_assitastance) are rather similar in both "collective" and "individual". On the other side penalties if you fail to deliver the agreed quantities (Penalties) can be considered as residual in the case of an "individual", but are quite significant in the case of "collective" selling arrangements. The same could be underlined in the case of safeguards if the buyer fails to fulfil the agreement (Safe), interest in case of delayed payments from the buyer (Interest), and services that buyers provide to the primary producers (Service) – like storage, transport and handling. However, regarding the price premiums for delivering higher quality products (Price_premiums) "individual" significantly outperforms "collective". This can be partly explained by higher bargaining

power of large farms relative to the small ones – which mainly use collective sales channels. Providing special assets, technology and/or machinery (Assets) and use of the automatic extension mechanism in the agreement (Extension) can be neglected in both cases in relative terms.

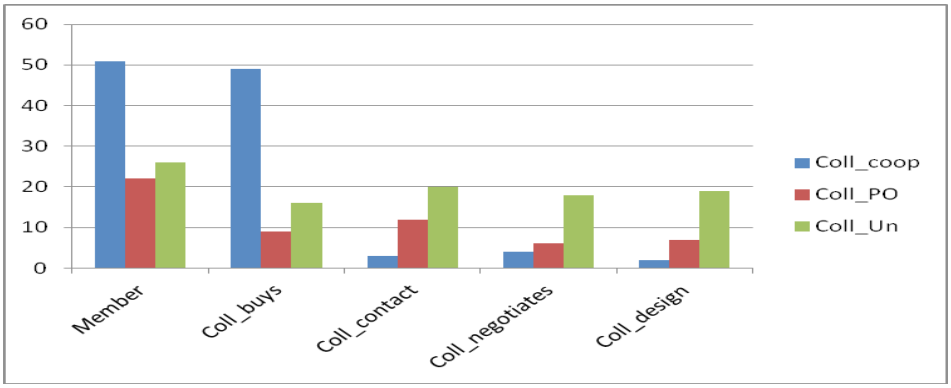
Figure 1. *The characteristics of collective and individual sale arrangements*



Source*: SUFISA farms survey (RS – wheat)*

Figure 2. further shows the statistics related to collective sales channels by answering the question what collective organisations do on behalf of their members. There are three categories of interviewed farmers that use some aspects of the collective sales channels in their practices – members of cooperatives (Coll_coop), members of producers' organisation (Coll_PO), and members of farmers' union/association (Coll_Un). The dominant portion of the total of these three categories belongs to the cooperatives. This organisation mainly serves as the buyers of their member's production, and in sporadic cases they help them to define and design their buying contracts, negotiate with final buyers and provide them with necessary contacts. The frequencies of producers' organisations and farmers' union/associations are similar. However, it seems that farmers' union/ associations are more valuable to the farmers than producers' organisations, regarding the buying, contracting, negotiating and contracts design activities.

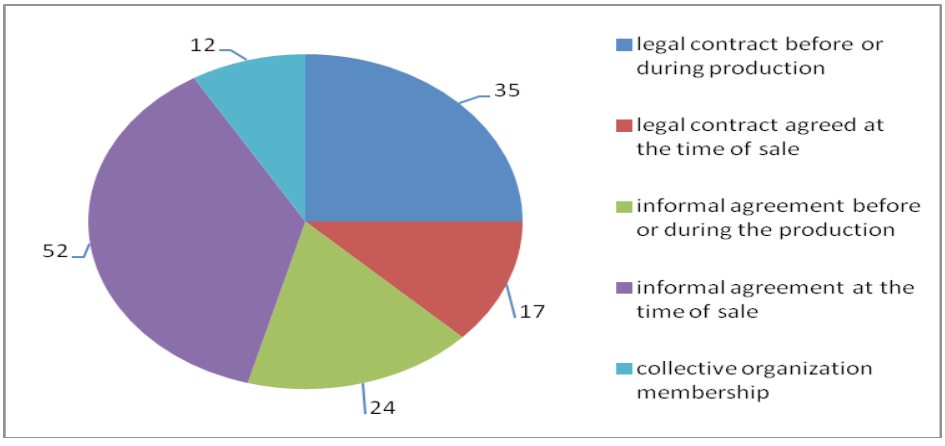
Figure 2. *Collective sale characteristics – What do collective organisations do on behalf of their members?*



Source: *SUFISA farms survey (RS – wheat)*

Formal and informal arrangements co-exist (Figure 3), although the informal arrangements are more popular and therefore, widely accepted. The informal agreement at the time of sale is most represented in our sample (n=52), followed by legal contract before or during production (n=35). The lowest frequency is recorded for collective organization membership (n=12). It might be controversial as collective type of sale dominates our sample. It can be explained by specific characteristic of the Serbian "cooperative" sector were limited number of farmers hold membership, while the majority of farmers are only the coop-partners (so-called "kooperanti"), referring that membership is not precondition for institutional arrangement with cooperatives in Serbia.

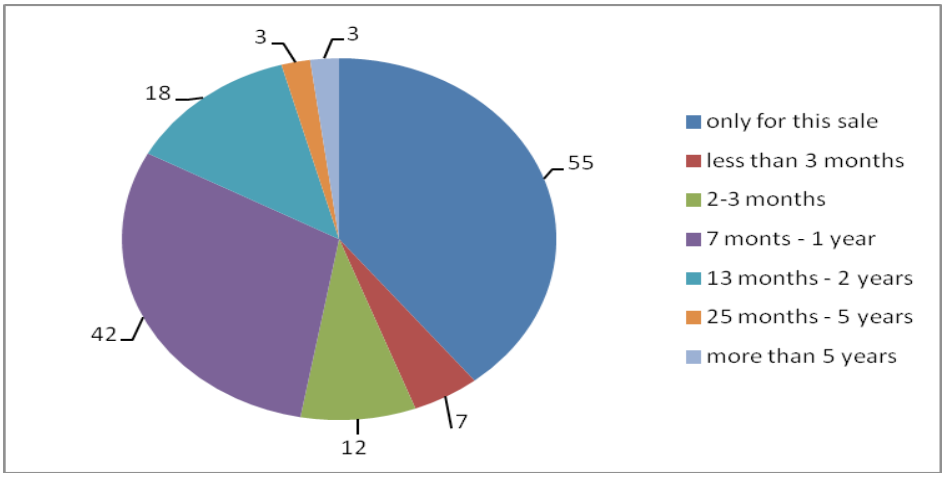
Figure 3. *Type of agreements*



Source: *SUFISA farms survey (RS – wheat)*

Most sales agreements are made either for particular sale (n=55), or they last between 7 months and 1 year (n=42). Surveyed farms reported limited number of medium (n=21) or long run contracts (n=3). As the short run arrangements between farmers and other stakeholders prevail (Figure 4), a lot of problems arise for our wheat farmers as they cannot count on stability of price arrangements. Without stable price arrangements, it is hard to run the farm business successfully.

Figure 4. *Duration of agreement*



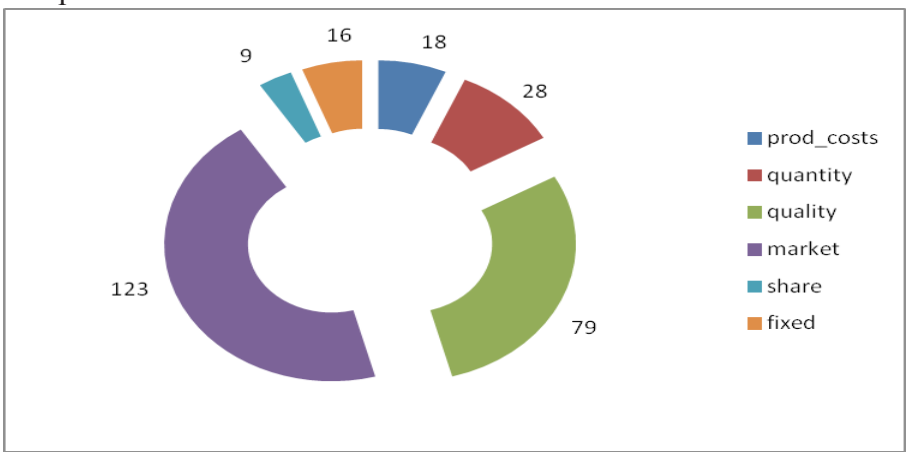
Source: *SUFISA farms survey (RS – wheat)*

The price is self-reported and based on average wheat price during the observed year (2016/17). The average price reported by farmers for the year 2016-17 is 0.15 EUR per kg. However, farmers who are involved in individual sale channels managed to reach a higher wheat price of EUR 0.166 per kg in comparison to the collective who get a price of EUR 0.143 per kg, on average. In the total sample of farms, production costs as share of selling price vary between 40-100%, being on average 76.69%.

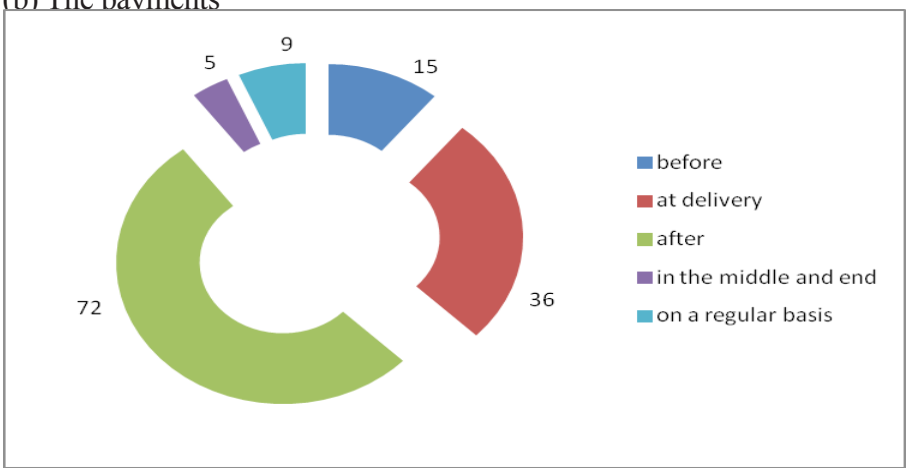
The interviewees were also asked to explain how the contract arrangement was set related to price discovery and payments to farmers. Figure 5 - panel (a), shows interviewed farmers reasoning of how the price they received is defined. Predominant frequency belongs to the market supply and demand conditions, while the rest of the pricing formation rests on the product quality. Other elements, such as farmer real production costs, quantities they produce, share in organisation's to which they sell, or relying on fix price based on the predefined agreement is the extremely rare reasoning of primary producers regarding the wheat pricing formula.

Figure 5. *Price and delivery settlement*

(a) The price



(b) The payments

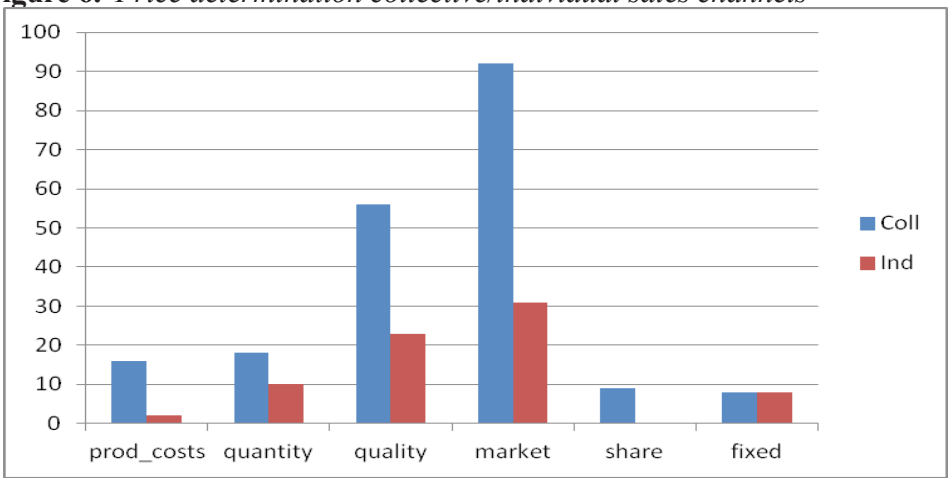


Source: *SUFISA farms survey (RS – wheat)*

On the other side, Figure 5 - panel (b), shows when the farmers get paid for delivered products. Most of the payments in this sample belong to the category "at delivery" of the product or even "after" that. Other categories are quite rare. "At delivery" category is an obvious consequence of normal market relations of primary producers with their buyers, and pricing formula mentioned above – which suggests the standard price formation. The category "after" may suggest the unfavourable position of the primary producers in the supply chain as they have to sell their products in advance, usually below the market price. If they had the opportunity to store their products and sell them in six to nine months after the harvest, the price would be much better.

Figure 6. separates the frequencies of collective and individual sales channels regarding the question "How is the price defined?" (See figure 5a) In relative terms, there are pretty close beliefs of farmers from both types of the sales channels that prices are based on delivered quality. With minor deviation, it can be said that this could also be the case with quantity. Production cost is almost unimportant in pricing formula in individual sales channels, but it is not the same regarding "collective" part of the sample. On the other side, demand and supply conditions determining price are present in both cases – with a slightly higher relative frequency in the case of "collective" arrangements. Beliefs that the price is based on the share of buying organisation's profit are negligible, and this can even be said for the facts related to the price fixing at the beginning of the agreement.

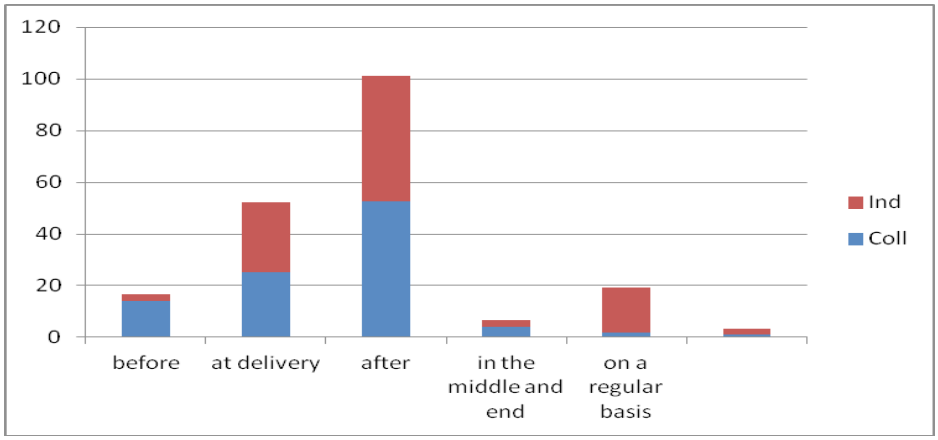
Figure 6. *Price determination collective/individual sales channels*



Source: *SUFISA farms survey (RS – wheat)*

From Figure 7, based on the relative frequencies, we can see that at delivery payments are more common to the individual sales channels, while payments before are more common to the "collective" ones. The last statement is in line with our previous finding of the inferior status of the small farmers and their apparent shortage of funds for working capital and therefore need to sell in advance. Finally, other elements of the graph show low and negligible frequencies, with important notice that payments on the regular basis are more important for individual arrangements than for collective ones.

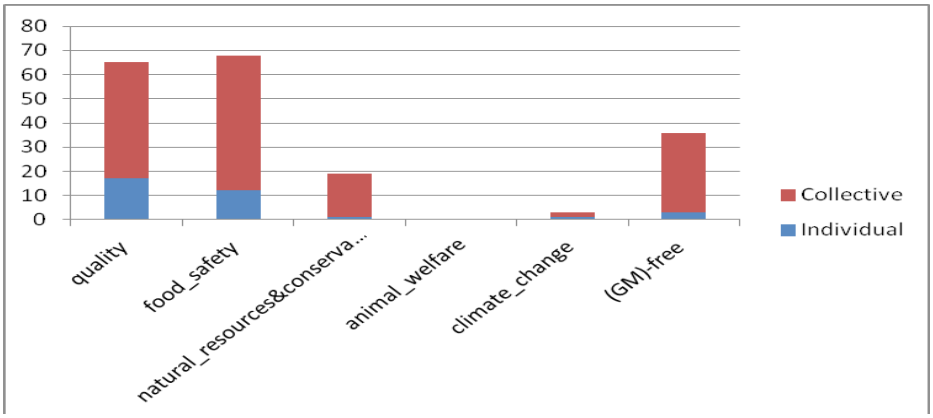
Figure 7. *Payments and collective/individual sales channels*



Source: *SUFISA farms survey (RS – wheat)*

Among the relevant standards, quality and food safety are mainly imposed to both collective and individual sales channels (see Figure 8). Animal welfare standards are not mentioned at all, while other sustainability-oriented standards (such as nature conservation and adaptation to climate change) are less frequent. Producers in Serbia are obliged to implement GM free practices.

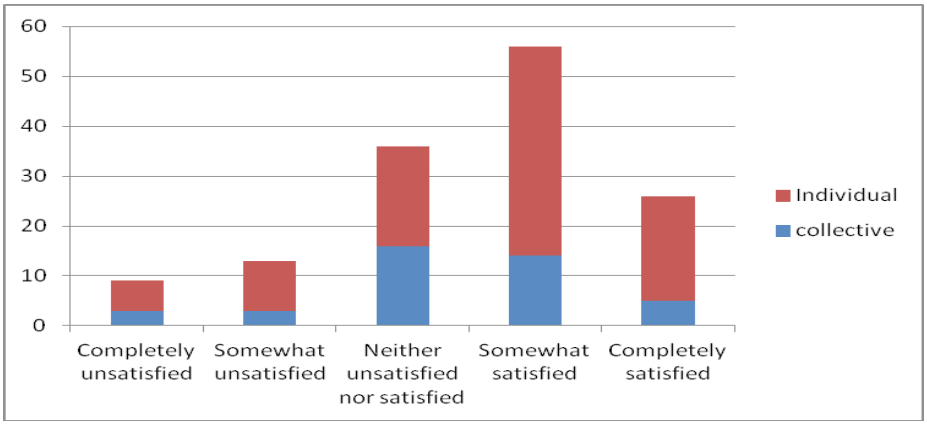
Figure 8. *Standards involved in two types of arrangements*



Source: *SUFISA farms survey (RS – wheat)*

Finally, the level of satisfaction in both sub samples indicates that farmers are generally more satisfied than unsatisfied with sales agreements (see Figure 9). However, the specific characteristics of analysed institutional arrangements still leave a lot of opportunities for further improvements.

Figure 9. *Level of farmers' satisfaction with contract arrangement*



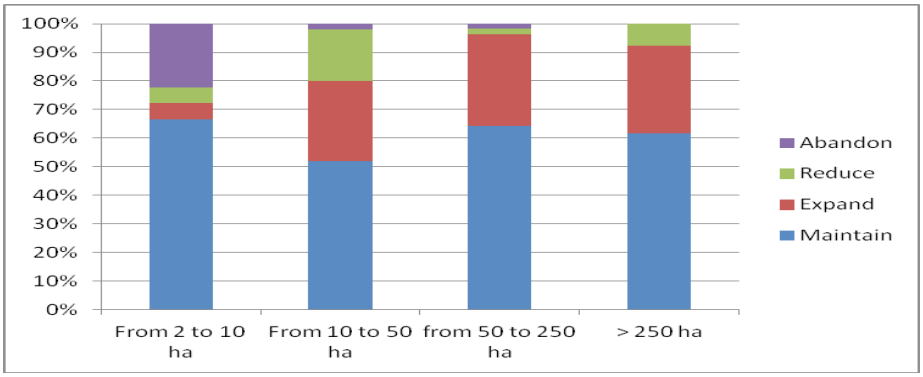
Source: *SUFISA farms survey (RS – wheat)*

The main aspects concerning benefits of existing types of contracts to farmers' sustainability are related to possibility to obtain higher prices than with some other types of arrangements. Generally, our respondents report a lower level of agreement with the following statements: (1) there are delays in the payments; (2) the production/quality standards required are too restrictive; (3) this sale agreement provides more possibilities for negotiating prices. In the case of the first statement a lower level of agreement is positive for the quality of arrangement applied in practice, while the third statement addresses reduced space for negotiation that farmers have in the context of price definition. Non-existence of production/quality standards or existence of lower requests for standards implementation cannot be considered as positive.

Discussion - farms strategies and main drivers

One of the main goals of this research is to stress out the future perspectives of wheat farmers in the Region of Vojvodina having in mind their own point of view, as well as to define the importance of different factors that will influence sustainability of farmers businesses in the long run. Farmers were asked to mark importance of different factors that were previously identified during the qualitative research such as climate change, price fluctuations (both of inputs and outputs), changing of consumer preferences, access to loans and credit, and changing regulation and policy measures.

Figure 10. *Strategies in the next 5 years*



Source: *SUFISA farms survey (RS – wheat)*

In the strategic context, the surveyed farmers reported what their strategies for the development of wheat within the context of their farm business in the coming five years are. The majority of farmers reported to maintain production. A slightly different pattern becomes for the group of farmers with total area from 10 to 50 ha, where a higher share of other strategic alternatives was noticed. Further expansion of production is more important for larger farmers (above 50 ha) than for other groups, while the highest share of response option "to abandon farming" was reported in the group of 10 to 50 ha. When it comes to age structure of farmers, younger farmers (below 40 years) are more prone to expand farm activity, while abandonment or reducing of farm activity is more present for older farmers. It is also important to notice that among farmers from 50 to 250 ha the group of older farmers is overrepresented, and many of the interviewed farmers in this group have no expectations regarding successors. It also refers to unfavourable demographic situation (aging population in the rural areas in Serbia).

When it comes to the specific strategies to be implemented in farmers' production activities, our research shows that insurance and investments dominate among selected options of the interviewed wheat farmers, which can be considered a favourable result from the aspect of preserving the financial stability of farms. While insurance is important for future activities for all farm size groups, investments are more present in the groups of larger farmers (above 50 ha of total area). The small farms (below 10 ha) have no plans or will try to externalize production activities. Similar to production, market plans include diversification and new forms of partnership in the context of better coordination and cooperation both among farmers and between farmers group and other food chain stakeholders

in Serbia. Furthermore, the active role of farmers is recognized in the area of sales channels innovation and income insurance as the strategic response to price fluctuations. However, almost one third of the interviewed farmers have no plans for their production activity in the future, while the lowest number of responses belong to farmers intentions to organize organic or other forms of production with added value.

Final remarks

It seems that formal and informal arrangements co-exist, although the informal arrangements are more popular and therefore, widely accepted in the observed sector. The informal agreement at the time of sale is most represented in our sample, followed by legal contract before or during production. The average wheat price is higher for the group of farms from 10 to 50 ha in comparison with other farm size groups (both in total and wheat area). Farmers who are involved in individual sale channels managed to reach higher wheat price of EUR 0.166 per kg in comparison to the collective price of EUR 0.143, on average. The price of wheat is in most cases defined based on the market supply and demand conditions.

Most sales agreements are made either for particular sale, or they last between 7 months and 1 year. Without stable price arrangements (in medium and long run), it is hard to run the farm business successfully. Additionally, most of the farmers in this sample get paid "at delivery" of the product or even "before" that, which implies standard form of price formation. At delivery payments are more common to the individual sales channels, while payments before are more common to the "collective" ones. The level of satisfaction in both sub samples (individual and collective arrangements) indicates that wheat farmers are generally satisfied with sale agreements.

The surveyed farmers mainly report that they plan to maintain the existing production scale. The larger wheat farmers (above 50 ha) report that they want to expand production (it is more important for this group than for other groups), while the highest share of response "to abandon" farming was reported in group of 10 to 50 ha. Among farmers from 50 to 250 ha the group of older farmers is overrepresented, and many of the interviewed farmers in this group have no expectations regarding farm succession (the strong demographic problem is present). Insurance and investments dominate among selected strategies, while market plans mainly include diversification and new forms of partnership in the context of

better coordination and cooperation. It might be directly caused by domination of informal agreements and, consequently, very low level of institutional support to the food chain functioning. There are different institutions at the second level, but most of the problems occur at third and fourth level (the less efficient regulations control and non-existence of diversified risk-bearing mechanisms). Whenever low level of institutional arrangements exists, the meaning of sustainability is limited mostly to economic and financial aspects of farms functioning. Are the policy makers fully aware of market failures importance and why don't they protect primary producers from unfair trading practices?

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FADN DATABASE AND STRUCTURAL STANDARD OPERATING RESULTS ACHIEVED ON FARMS IN THE REPUBLIC OF SERBIA

Zorica Vasiljević[1], Mirjana Bojčevski[2]

Abstract

The Farm Accountancy Data Network (FADN) system represents a source of data of a high reliability level that is suitable for carrying out economic analyzes in the field of agriculture. The FADN methodological framework enables the extrapolation of data on economic results obtained from a predefined sample of farms to the entire agricultural sector. In addition, it is also possible to compare the obtained results with relevant indicators from all EU member states. Standard results calculated at the level of the Republic of Serbia represent weighted average for farms, which show the state of the entire agricultural sector in Serbia. Only farms of economic size over 4,000 € make up the field of research of the implemented FADN system in Serbia (total population). The completed sample for 2016 was made up of 1,104 farms that exceeded the set threshold at the time of data collection. The field of research of the FADN system covers about 31.8% of the total number of farms, which had about 90% of the used agricultural area (UAA) and generated a dominant part of the agricultural production value. The paper presents the structural standard results achieved in 2016 at the level of two regions of the Republic of Serbia, as well as the comparison of these indicators with the same ones achieved in the EU member states.

Key words: *farms, standard results, FADN, Serbia.*

Introduction

All EU countries through FADN system collect annually the technical, financial and economic data from over 82,000 farms which represent about 5 million farms in European Union. The FADN concept was established in 1965. After

1 Zorica Vasiljević, Ph.D., Full Professor, University of Belgrade, Faculty of Agriculture, Nemanjina Street no. 6, 11080 Belgrade-Zemun, Serbia, Phone: +381 64 14 39 942, E-mail: vazor@agrif.bg.ac.rs

2 Mirjana Bojčevski, M.Sc., Adviser, Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia, 11000 Belgrade, Serbia, Phone: +381 11 36 10 604, E-mail: mirjana.bojcevski@minpolj.gov.rs

many years, FADN has developed into a unique system that represents the obligations of the EU member states and which is regulated by EU regulations. The candidate countries also have an obligation to establish this system before accession to the European Union and in that process they are assisted by the European Commission which has financed the projects of FADN system establishment.

The first attempts to collect and analyze accounting data on family farms in Serbia were recorded in the first half of the 20th century. The first book-keeping researches on family farms in Serbia were organized at the Bureau for Science on Agricultural Management with experimental field (1921) at the Faculty of Agriculture and Forestry in Belgrade (Vasiljević et al., 2008).

After the Second World War the book-keeping research on family farms was carried out on the basis of an extensive survey made by the Institute for Agricultural Economics in Belgrade, but these investigations were discontinued in 1981 due to the lack of financial resources and the absence of interested financiers for this type of research (Vasiljević, 2012).

After two decades of interruption, attempts have been made to establish again the book-keeping researches on family farms. The Institute for Science Application in Agriculture from Belgrade, in cooperation with regional agricultural services, conducted in 2001-2004 period a survey and collected some accounting data for 1,774 family farms, on the basis of which the analyzes and researches have been carried out. Unfortunately, this survey was not continuous as well, i.e. it was interrupted in 2004 and 2005, and then again since 2006 it has been continued on a representative sample of 3,590 Serbian family farms.

Until 2011 there was no systematic and continuous monitoring of accounting data on family farms in Serbia. At the end of 2011 it started realization of the project "Establishment of the accounting data network on the family farms in Serbia". The system of recording accounting data on family farms in Serbia is based on the so-called FADN (Farm Accountancy Data Network) methodology, which is applied in EU countries. This is a unique system of microeconomic data, which is compatible with the systems existing in the EU member countries and whose function is to monitor the results of operations in agricultural enterprises, cooperatives or at the family farms. In the initial year (2011) of the FADN system establishment and beginning of functioning in Serbia, the collection of data was based on 40 family farms. In the next year (2012), the sample was in-

creased to 172 family farms with a successive annual increase in order to reach the volume of 1,104 family farms in 2015. The data collection cycle for 2016 included 1,300 farms, of which 1,292 were validated and included in the analysis. It is planned that the sample will increase up to 2,000 farms, which would be a representative sample for commercial farms in the Republic of Serbia.

Methodology

The greatest challenges of the FADN system in the EU member states is an application of the methodology for selecting farms in terms of number, type and economic size, as well as the motivation of farmers to agree to be part of the system. The dissemination of FADN results are based on "Standard Results" generated on the basis of validated and aggregated FADN Farm Returns and checked by the European Commission. The standard results are a set of statistics, computed from the Farm Returns that are periodically produced and published by the Commission. These are available in a Public Database. They describe in considerable detail the economic situation of farmers by different groups throughout the EU (Bojčevski et al., 2016).

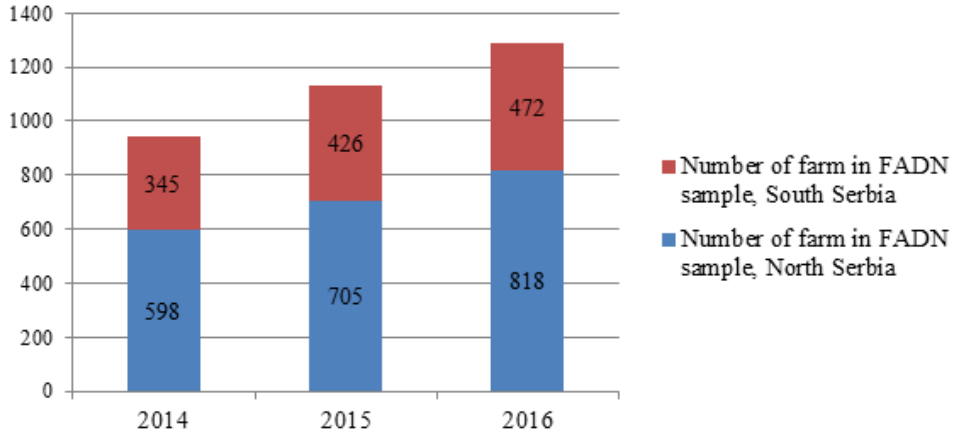
The Commission has defined each variable in the Standard Results, attempting to ensure a close correspondence between the definitions of its own variables and those of other organizations producing agricultural statistics. The Commission has also defined a method to derive main income and capital variables (Bojcevski et al., 2015).

The standard results calculated at the level of the Republic of Serbia represent weighted average for farms, which show the state of the entire agricultural sector in Serbia. According to the 2012 Agricultural Census for the Republic of Serbia, 631,552 farms were listed. Out of this number, 200,895 farms exceed the pre-defined lower limit of economic size (around 430,000 small farms are excluded). Only farms of economic size over 4,000 € make up the field of research of the implemented FADN system in Serbia (total population). The completed sample for 2016 consisted of 1,300 agricultural holdings that, at the time of data collection, exceeded the set threshold, of which 1,292 were validated and included in the analysis. The field of research of the FADN system covers about 31.8% of the total number of farms, which had about 90% of the used agricultural land, and generated the dominant part of the agricultural production value. The paper presents the structural results at the level of the two regions of the Republic of Serbia (Ser-

bia-North and Serbia-South) for 2014, 2015 and 2016, as well as the comparison of these indicators with the same ones in EU Member States.

The FADN National Committee of the Republic of Serbia has established the following criteria for determining the field of FADN research: two FADN regions - Serbia-North and Serbia-South, a threshold of economic size of 4,000 €, 10 basic types of farms, 14 basic groups of economic size and a representative number for the FADN sample of about 2,000 farms.

Graph 1. *The size of the FADN sample for the Serbia-North and Serbia-South regions (2014-2016)*



Source: *Authors based on data from FADN database*

For the purpose of this paper, the desk research method and method of interview with relevant experts have been used, method of descriptive statistics, comparative method and theoretical analyses as well. Analyzes were conducted for the period 2014-2016.

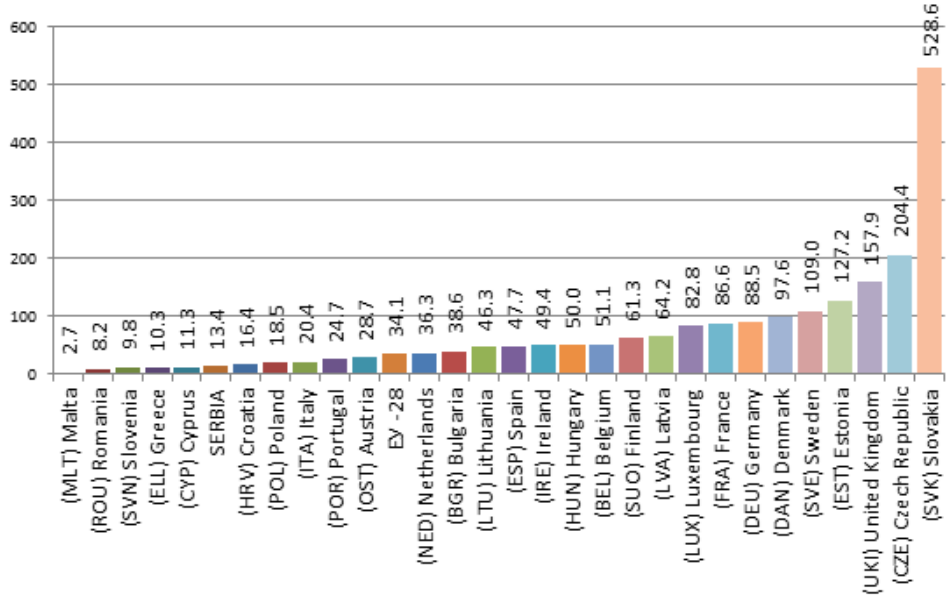
Results and Discussion

The reports obtained from the FADN database clearly show that the structure of farms varies considerably in Serbia in relation to the EU member countries, but also among the member countries themselves. One of the indicators with the most significant differences is the physical size of the farm expressed in the average size of agricultural land per farm (UAA).

Utilyzed Agricultural Area (UAA)

The farms represented in FADN are as an average the largest in Slovakia (528 ha), then in Czech Republic (204 ha) and the United Kingdom (157 ha). The farms are the smallest in Greece (10 ha), in Cyprus (11.3 ha) and in Malta (2.7 ha). The EU average in 2016 was 34.1 ha. The Republic of Serbia with an average of 13.4 ha is below the EU-28 average. The average size of the farms was generally below the EU-28 average in some countries (Austria, Poland and Romania). The utilized agricultural area in some EU countries and in Serbia is shown on Graph 2.

Graph 2. *Total utilized agricultural area (UAA) in the EU member states and Serbia (an average per farm in ha)*[3]

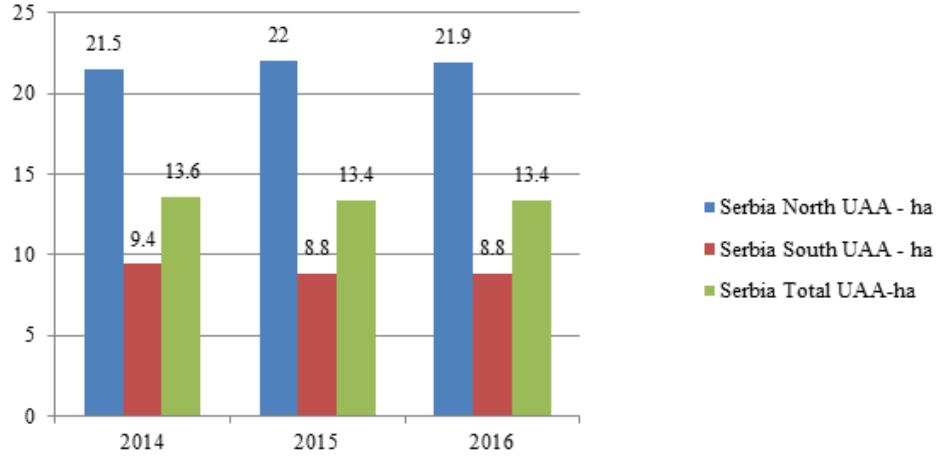


Source: *FADN database of MAFWM and FADN EU database (2015)*[4]

3 The average farm size is based on the FADN research, which does not cover all agricultural branches in the EU, but only those that can be considered as the commercial ones due to their size. Therefore, the interpretation and use of the above mentioned average farm size should be carefully considered.

4 FADN EU database - Directorate General for Agriculture and Rural Development (DG AGRI) EU-FADN, (http://ec.europa.eu/agriculture/rica/database/database_en.cfm).

Graph 3. *Total used Agricultural Area (UAA), (2014-2016), Serbia-North and Serbia-South, (an average per farm in ha)*



Source: *FADN database of MAFWM*

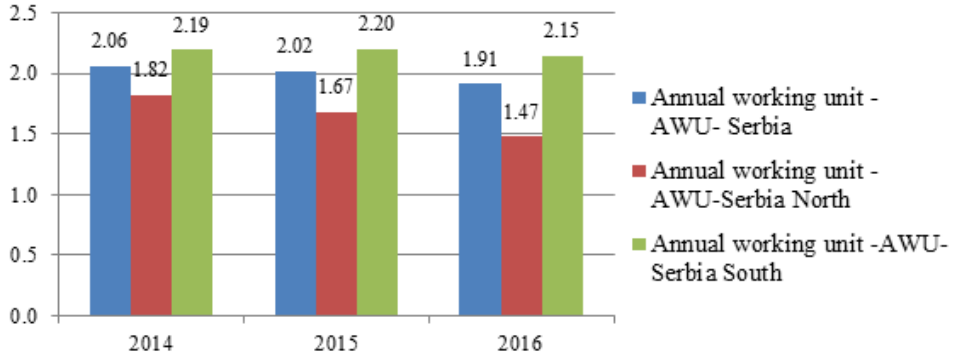
The average size of used agricultural land per farm in Serbia in the 2016 sample was 13.4 ha. The results confirm significant differences in the UAA between Serbia-North and Serbia-South regions, which can be seen in Graph 2.[5]

Labor Consumption

The average labor consumption per farm in the Republic of Serbia in 2016 was 1.9 annual working unit (AWU), of which 84% makes unpaid labor, while 16% is paid labor. Due to larger farms and the significant representation of crop production, where the mechanized work is mostly used, the labor consumption in the Serbia-North region is considerably lower than in the Serbia-South region.

5 The total utilized agricultural area includes arable land, meadows, permanent pastures and perennial plantations. The value is obtained through the statement of the agricultural producer, and it is recorded as the sum of the total agricultural land, whether owned by the farm or rented, or used for own agricultural production during the accounting year.

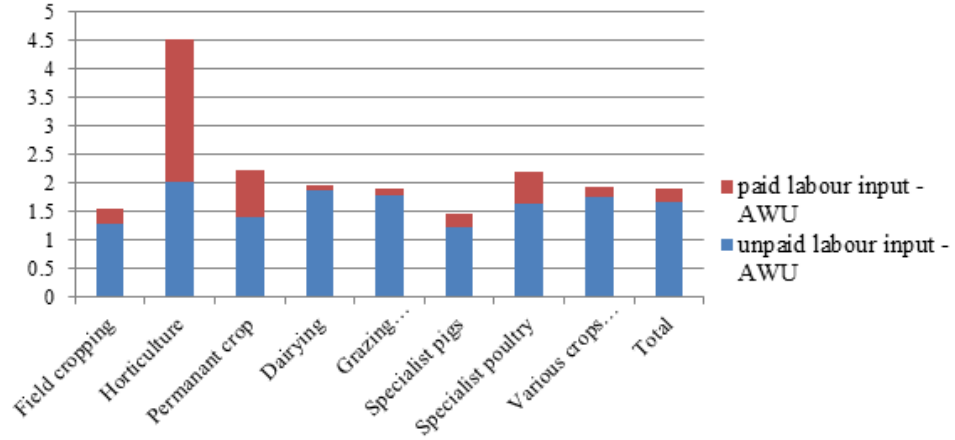
Graph 4. *Annual working unit in Serbia, Serbia-North and Serbia-South (an average per farm)*



Source: *FADN database of MAFWM*

The largest labor consumption is on the vegetable production farms (production in greenhouses and plastichouses), which employ four people on average (4.5 AWU, of which 2.5 AWU makes unpaid labor), which confirms the fact that vegetable production is more intensive than other types of production. On the other side, the smallest consumption of labor, (1.5 AWU) exists on the farms dealing with crop production and pig farming[6].

Graph 5. *Annual working unit by type of farming (AWU)*



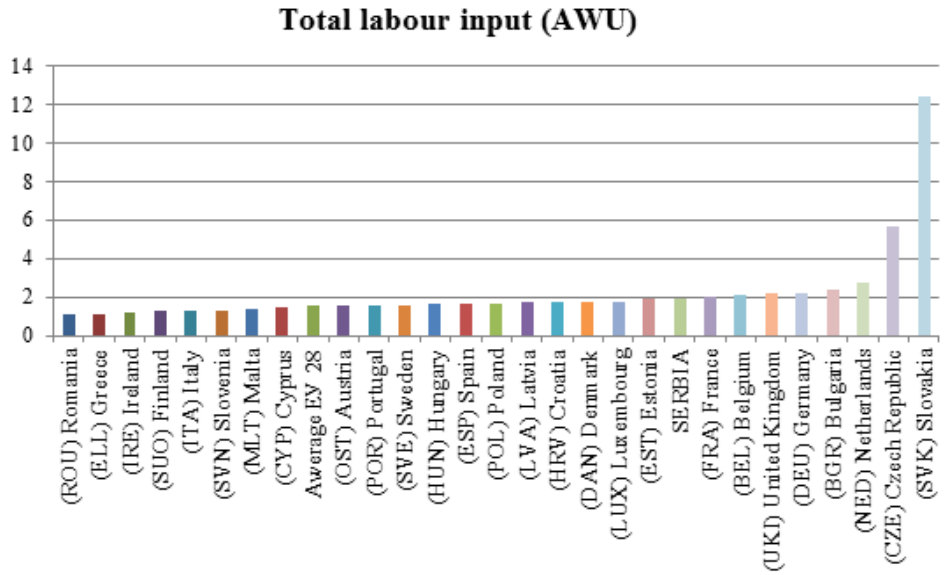
Source: *FADN database of MAFWM*

6 The total labor cost is expressed in Annual working units (AWU) and represents the equivalent of the full-time worker. In the Republic of Serbia one Annual working unit corresponds to the work of one person full-time engaged on the farm. One AWU is defined at the level of 1,800 working hours (equivalent to 225 working days with 8 working hours).

The average number of labor per farm in EU-28 in 2016 was 1.5 AWU. However, the number differed considerably in individual member states and ranged from 15.5 AWU in Slovakia to 1.1 AWU in Greece.

The average number of Annual working units (AWU) per farm in horticulture (the sector with higher participation) was about 2.5 times higher than for perennial plantations (the sector with the least number of working units). The share of unpaid labor (expressed as working hours of the family members) accounted for 77% of the total labor force in the EU-28 and it was the prevailing form of labor in most member countries, except in Slovakia, Czech Republic, Hungary, Estonia, Denmark and Bulgaria. In these EU member countries, the share of family labor in total labor was below 50%.

Graph 6. *Annual working unit (AWE) in Serbia and* EU-*28*



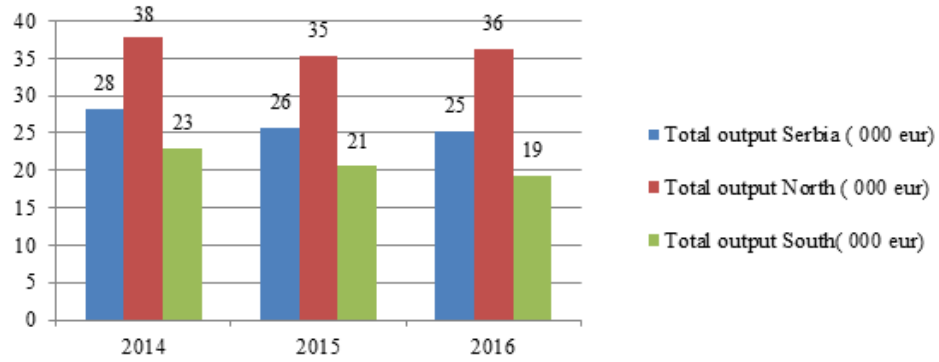
Source: *FADN database of MAFWM and FADN EU database (2015)*[7]

7 FADN EU database - Directorate General for Agriculture and Rural Development (DG AGRI) EU-FADN (http://ec.europa.eu/agriculture/rica/database/database_en.cfm).

Total Value of Production (Output)

The total value of production (output) in the Republic of Serbia was in 2016, on average, about 2.7 million dinars or 25 thousand €.[8] The results of the FADN research show that there are major differences between the Serbia-North and Serbia-South regions. The reason for such a large differences lies in the structure of the farms in the FADN sample, mainly those belonging to categories of larger economic size.

Graph 7. *Total output in Serbia, Serbia–North and Serbia-South (average per farm)*

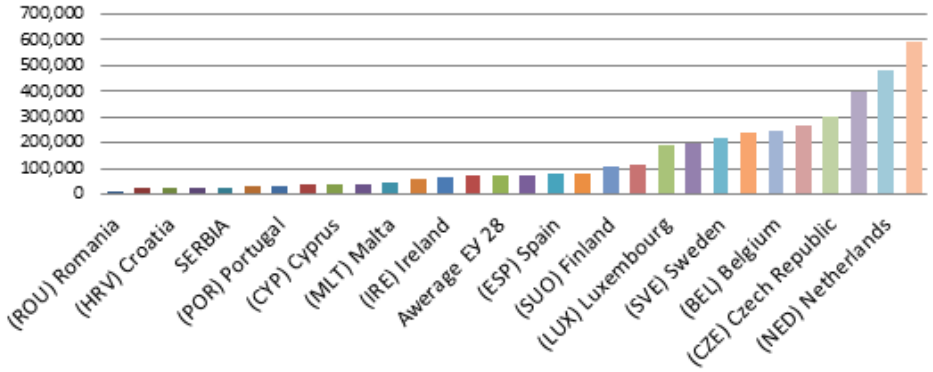


Source: *FADN database of MAFWM*

By comparing this indicator for Serbia with EU member countries, it can be concluded that the Republic of Serbia belongs to the group of countries with the lowest, below-average values (72 thousand € in 2015). The highest total value has Slovakia (about 600 thousand €), the Netherlands (480 thousand €) and Denmark (396 thousand €).

8 The total value of production expressed in dinars is the value of crop production and products, livestock production and products and other products and services.

Graph 8. *Total output in Serbia and EU-28 in 2015*



Source: *FADN database of MAFWM and FADN EU database (2015)*[9]

Farm Net Value Added

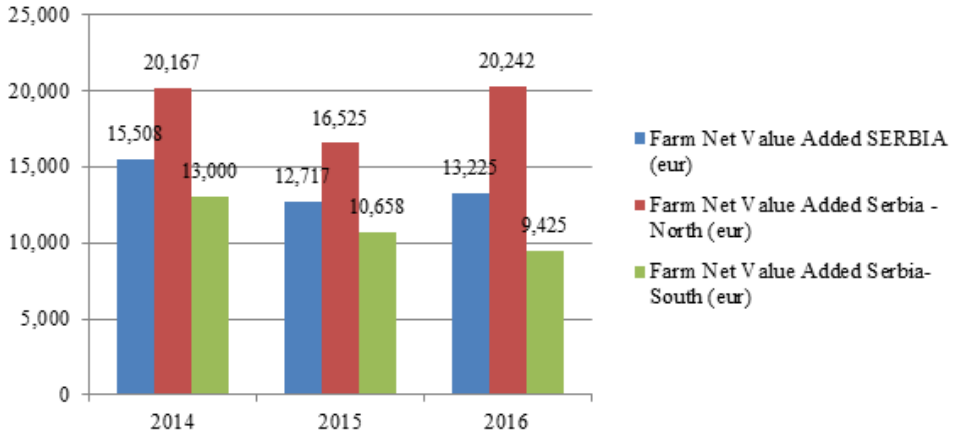
Very important indicators in FADN databases, which indicate the success of the farm's business, are the Farm Net Value Added (FNVA) and the Farm Net Income (FNI).

The Farm Net Added Value (FNVA) points to the contribution of all factors of production (land, capital and labor), both owned by the farm and externally engaged.[10] In 2016, the average Farm Net Added Value per farm in Serbia was just over 13 thousand €, and it was significantly higher in Serbia-North region (20 thousand €) compared to the Serbia-South region (9.5 thousand €).

9 FADN EU database - Directorate General for Agriculture and Rural Development (DG AGRI) EU-FADN (http://ec.europa.eu/agriculture/rica/database/database_en.cfm)

10 The Farm Net Value Added (FNVA) is equal to the sum of the total value of production and support from public funds (the difference between the current values of subsidies and taxes) minus intermediate consumption (specific and overheads) and depreciation. It represents an indicator of the farm economic performance from whom it is necessary to pay salaries, leases and interest, as well as its own factors of production. When it is expressed in terms of the Annual Working Unit (AWU), it takes into account the differences in the compensation for the farm labor force.

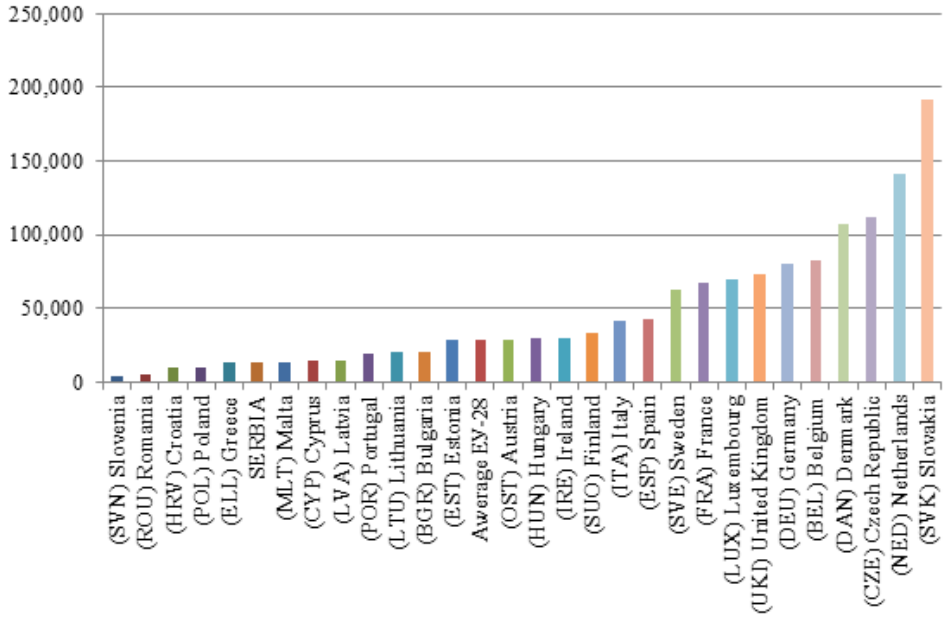
Graph 9. *Farm Net Value Added in Serbia, Serbia-North and Serbia-South (average per farm)*



Source: *FADN database of MAFWM*

The Farm Net Value Added (FNVA) varies considerably in the EU member countries. The highest FNVA in 2015 was in Slovakia and it amounted to 176 thousand € per farm. This is almost 30 times more than in Slovenia, the country where the lowest value of FNVA was recorded in the same year. Denmark, the Netherlands and the Czech Republic also had high FNVA values. The average EU-28 amounted to about 28 thousand €. The increased value of the average FNVA per farm (agricultural holdings) depends on the size of the agricultural holding, the type of agricultural business, and the pace of structural reduction in the labor force employed in agriculture. In order to overcome these differences, FNVA is usually expressed per AWU, which can be considered as a measure of partial labor productivity.

Graph 10. *Farm Net Value Added in Serbia and* EU-*28 in 2015*



Source: *FADN database of MAFWM and FADN EU database (2015)*[11]

The Farm Net Value Added (FNVA)[12] is an indicator that measures remuneration for all fixed production factors, whether external or internal-family ones (gross profit of a farm minus the depreciation costs). When calculating this indicator, external factors of production (paid salaries, paid rent, paid interest and financial charges) must be excluded, by which we calculate the Farm Net Income (FNI).[13]

The analysis of these indicators shows that there is a different profitability of farms in EU member countries, so that the indicator of the Farm Net Income (FNI) in Slovakia was the lowest of all countries in 2015, while in the same country the Farm Net Value Added (FNVA) was the highest. The reason for these indicators in Slovakia is that in this EU member countries the small family farms use a small percentage of total agricultural land, while 80% of agricultural land is used by large farms which have legal status and paid labor force.

11 FADN EU database - Directorate General for Agriculture and Rural Development (DG AGRI) EU-FADN (http://ec.europa.eu/agriculture/rica/database/database_en.cfm).

12 FNVA/Farm Net Value Added in the member countries in 2015 (an average per farm in €).

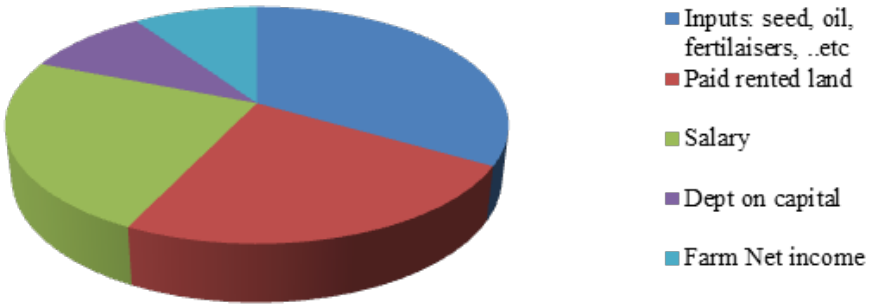
13 FNI/Farm Net Income added in the member countries in 2015 (an average per farm in €).

The agriculture of Serbia is characterized by the high share of small farms that produce relatively small production value, and accordingly, the amount of the Farm Net Value Added in Serbia is relatively small and it is below the average of the EU member countries.

Farm Net Income

The structure of total farm income distribution shows the profitability of the farm. When analyzing the business of the farm, it is important to determine the value of the Farm Net Income, i.e. the return realized on own capital, unpaid labor and own management.[14]

Graph 11. *Structure of total farm income distribution in Serbia in 2016*

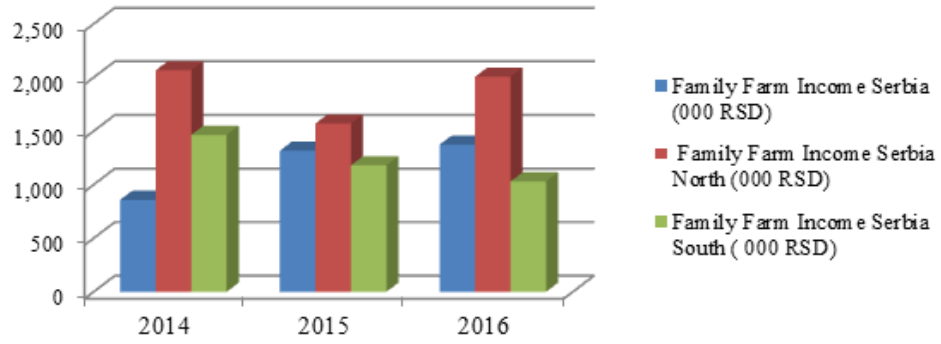


Source: *FADN database of MAFWM*

The Farm Net Income (FNI) in 2016 in Serbia amounted to 1.37 million dinars or about 11 thousand € per year, which is below the average of EU member countries. The FNI in the Serbia-North region is significantly higher than in the Serbia-South region, indicating to the higher volume of production (a greater number of hectares, a greater number of livestock heads, etc.), and consequently to the realized value of production i.e. more efficient use of resources at the farms in the Serbia-North region.

14 The Farm Net Income (FNI) represents the profit left to the agricultural producer and his family after covering all costs.

Graph 12. *Farm Net Income in Serbia, Serbia-North and Serbia-South (average per farm)*

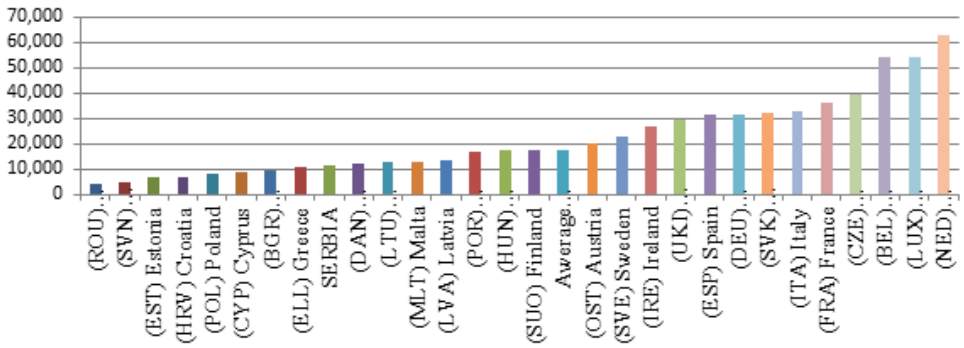


Source: *FADN database of MAFWM*

The average Farm Net Income in 2015 in EU member countries was about 17 thousand € per year, while some member countries realize over 50 thousand € per year. The Netherlands has maintained its leading position in terms of the Farm Net Income (62 thousand €), which indicates that income is still sufficient to finance estimated family production factors, even after all external factors have been exempted.

The farms based on family labor (unpaid), as it is the case in the Netherlands, Belgium and Luxembourg, have the largest Farm Net Income.

Graph 13. *Farm Family Income in* EU-*28 and Serbia*



Source*: FADN database of MAFWM and FADN EU database (2015)*[15]

15 FADN database of EU - Directorate General for Agriculture and Rural Development (DG AGRI) EU-FADN (http://ec.europa.eu/agriculture/rica/database/database_en.cfm).

Conclusion

Since 2011, Serbia has started the process of establishing a network for collecting and monitoring accounting data on selected family farms according to the FADN methodology applied by EU member countries and candidate countries. The obtained data serve as an instrument for increasing the efficiency of production and profitability of family farms in Serbia, but also for guiding more successful agricultural policy and the concept of support to family farms. Given that FADN is a unique methodology applied in all EU member countries and candidate countries, this also allows comparisons and comparative analyzes between Serbia and other countries.

The paper presents and explains the structural standard results of the farm business operations that can be monitored on the basis of the FADN database. It has been made a time comparative analysis of the achieved results in Serbia in three consecutive years (2014-2016), as well as a spatial comparison between Serbia and the EU-28 countries. The data on farms in Serbia in general and in two separate regions of Serbia-North and Serbia-South were analyzed. The analysis has shown that the structure of farms varies considerably in Serbia in relation to the EU member countries, but also among the member countries themselves.

One of the indicators with the most significant differences is the physical size of the farm expressed in the average size of agricultural land per farm (UAA). The Republic of Serbia with an average of 13.4 ha is below the EU-28 average. The average labor consumption per farm in the Republic of Serbia in 2016 was 1.9 annual working unit (AWU), of which 84% makes unpaid labor, while 16% is paid labor. Due to larger farms and the significant representation of crop production, where the mechanized work is mostly used, the labor consumption in the Serbia-North region is considerably lower than in the Serbia-South region.

The total value of production (output) in the Republic of Serbia was in 2016, on average, about 2.7 million dinars or 25 thousand €.[16] The results of the FADN research show that there are major differences between the Serbia-North and Serbia-South regions. The Farm Net Income (FNI) in 2016 in Serbia amounted to 1.37 million dinars or about 11 thousand € per year, which is below the average of EU member countries. The FNI in the Serbia-North region is significantly

16 The total value of production expressed in dinars is the value of crop production and products, livestock production and products and other products and services.

higher than in the Serbia-South region, indicating to the higher volume of production (a greater number of hectares, a greater number of livestock heads, etc.), and consequently to the realized value of production i.e. more efficient use of resources at the farms in the Serbia-North region.

The agriculture of Serbia is characterized by the high share of small farms that produce relatively small production value, and accordingly, the amount of the Farm Net Value Added in Serbia is relatively small and it is below the average of the EU member countries.

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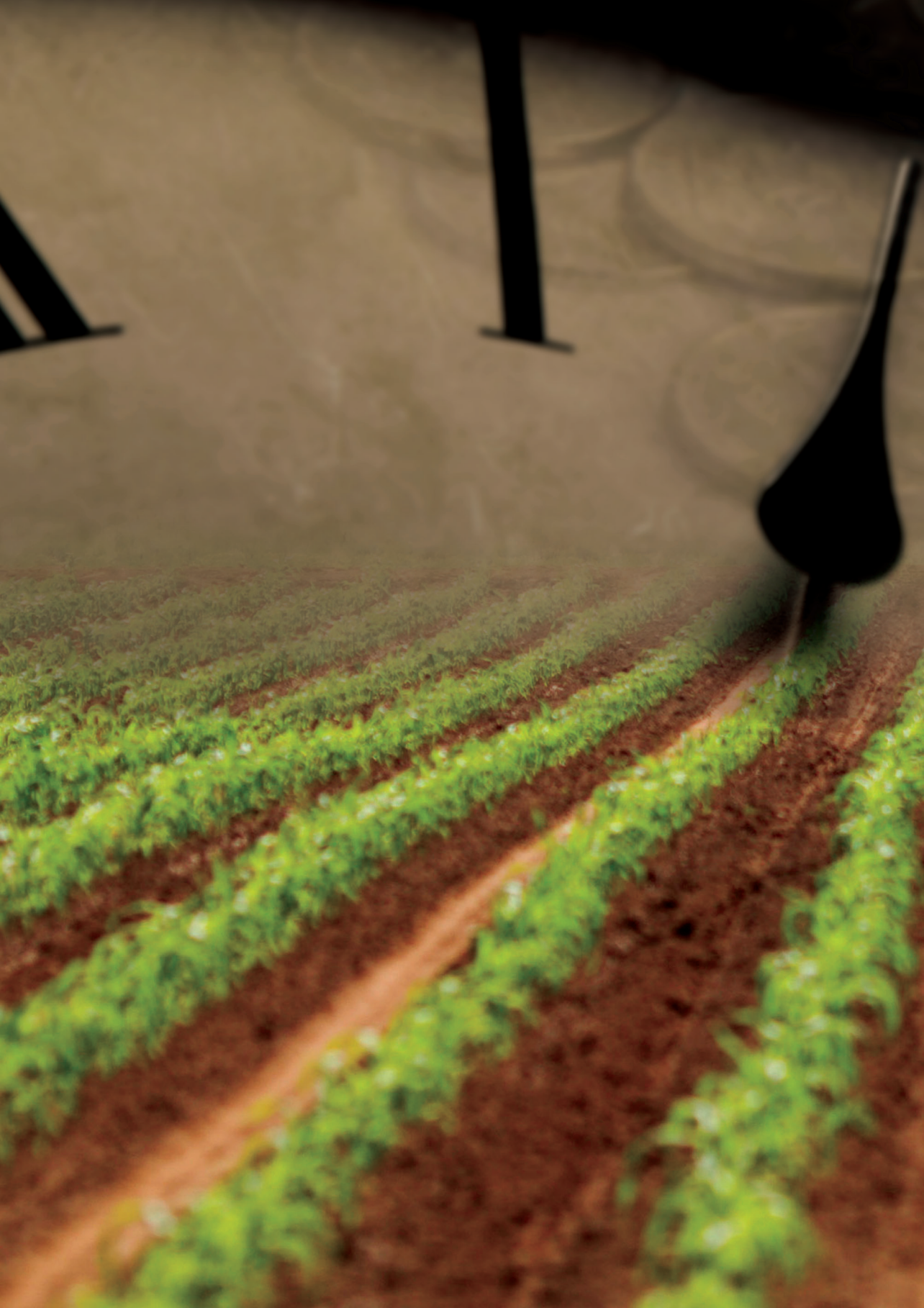

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