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THE DEVELOPMENT OF THE MARKET PRODUCTION OF CEREALS IN SERBIA: EXAMPLE WHEAT AND CORN [1]

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Abstract

In the paper, the tendencies in the development of wheat and corn production in the time period from 1976 to 2010 are researched, with a focus on the cluster analysis of the market production of these products per districts in Serbia in 2009. On the basis of more important available land capacities, the volume of production and scope of economic development, the I-distance method is used to rank the districts. The ranking of the districts according to the analysed characteristics is conducted on the basis of the median value of data per municipalities. For each of the mentioned groups of characteristics, the I-distance is used to rank the districts from 1 to 25, Rank 1 being the best and Rank 25 the worst. The similarities of the districts according to the analysed characteristics are accounted for by a complete link method of a hierarchical cluster analysis and the results are represented by a dendrogram and a cartogram.

Apart from favourable conditions (land, climate, and so on), producers' traditional habits have to the greatest extent had an impact on the unjustifiably high presence of wheat and corn in the structure of crop production. That, to a great extent, has had an influence on the high marketability of the production of wheat and corn in Serbia as well.

Key words: *market production, wheat, corn, I-distance, cluster analysis.*

JEL: *Q13, R11, O11*

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Introduction

Researching the development of market production in the Serbian agriculture is necessary for big changes that have occurred on the world economic stage, overall economic development, revealed recessional tendencies and the opposition of development at the end of the last and at the beginning of this century, as well as of gaining an insight into certain specificities in the development of agriculture under the influence of economic-systemic and economic changes. For all that, there is a need for acquiring current scientific knowledge of the development of market production in agriculture in a modified internal and external market environments, all the more so because the export of agricultural goods is one of rare positive items in Serbia's foreign-trade balance.

In the past 30 years, Serbia's agriculture has gone through significant qualitative changes reflected in an increase in market production, a high degree of deagrarianization, an increase in the level of productivity, a decrease in the share of primary production and an increase in the share of processing industries in the structure of GDP etc. The global process of industrialization has an influence on the development of the market of agrarian products, provides contemporary inputs for agriculture and allocates the surpluses of workforce from agriculture, thus creating conditions for a faster economic development. The overall economic development, industrial in particular, influences the development of agriculture. On the other hand, the development of market production is a clear indicator of the economic and material development of a country. Market production is directly connected with the intensity and fastness of the overall economic and industrial development.

Crop production, especially the production of wheat and corn, is a significant segment of the overall development [4] of agriculture. It represents the basis for the development of cattle production and processing industries, which, ultimately, is a precondition for the diversification of the agro-industrial sector. Differences in the natural and economic conditions of the production of wheat and corn have an influence on the degree of marketability per districts in Serbia. An increase in the scope and degree of marketability has an influence on the development of agriculture, i.e. the development of the overall economy.

The aim of this paper is to determine the development of the market production of wheat and corn per districts in Serbia on the basis of the characteristics of land capacities (5 characteristics), production (8 characteristics) and development (4 characteristics). On the basis of the said characteristics, the I-distance was used for ranking the districts.

By gaining an insight into the three groups of characteristics, the results of the research are deemed to be the basis for the implementation of the optimal production regionalization and the application of a unique agrarian policy for the districts, i.e. municipalities belonging to the same cluster.

4 In the structure of the value of Serbia's agricultural production, crop production has an over 50% share, whereas in developed countries, the share of cattle production as a higher stage of processing compared to crop processing is over 70%.

The working method and data sources

By a comparative analysis, we determined that there is a significant differentiation between the districts according to the degree of the marketability of wheat and corn production. Apart from marketability, the paper also gains an insight into differences in available land capacities, the volume and structure of production and the level of development per districts in Serbia.

An analysis of the degree of the marketability/volume of the production of cereals has been published for the two most represented products: wheat and corn.

The ranking of the districts by the I-distance method [5] was conducted on the basis of the following three groups of characteristics: **a) land capacities (5, from x_1 to x_5)** (x_1 – the share of arable land in agricultural areas, x_2 – the share of plough-fields and gardened areas in arable areas, x_3 – the share of areas under cereals in ploughed areas, x_4 – the share of areas under wheat in areas under cereals, x_5 – the share of areas under corn in areas under cereals), **b) production (8, from x_6 to x_{13})** (x_6 – areas under wheat in ha, x_7– wheat yields in t/ha, x_8– wheat production in tons, x_9– the wheat production marketability degree, x_{10}– areas under corn in ha, x_{11}– corn yields in t/ha, x_{12}– corn production in tons, x_{13}– the corn production marketability degree), and **c) the level of development (4, from $x_{14}$to x_{17})** (x_{14}– NI/capita, x_{15}–the share of agriculture in the NI of the economy, x_{16}– the percentage of an increase/decrease in the number of the population in 2009 compared with 2002, x_{17}–the percentage of agricultural population).

On the basis of data per municipalities, it was determined that there is a significant difference between the middle value and the median calculated for data at the district level because the analyzed characteristics per municipalities do represent a normal distribution of data at the district level. The ranking of districts according to the analyzed characteristics was conducted on the basis of the median value of data per municipalities. For each of the mentioned groups of characteristics (land capacities, production, development), the I-distance was used to rank the districts from 1 to 25, Rank 1 being the best and Rank 25 the worst.

$$D_k = \sum_{i=1}^{n} \frac{|X_{1k} - X_1^-|}{S_1} \prod_{j=1}^{i=1} (1 - r_{ij})$$

By applying the cluster analysis, homogenous groups of districts were defined from the viewpoint of the degree of the marketability/volume of cereals (corn and wheat) production. The similarities of the districts according to the analyzed characteristics of wheat and corn production are defined by the Euclidean measure of distance, while a complete link method was used to group Serbia's districts. The generated results of the hierarchical classification are accounted for by a dendrogram and a cartogram.

5 Ivanović's Distance.

For the purpose of analyzing the characteristics of land capacities and production (x_1-x_{13}), data published by the Republican Agency for Statistics in *Municipalities in the Republic of Serbia in 2009* were used. Since the year 2006, no data of the characteristics of the level of development (x_{14}-x_{17}) per districts have been published, so, to generate those characteristics, the publication *Municipalities in the Republic of Serbia in 2005* was used.

Wheat and corn production and degree of marketability

Traditionally, cereals represent the leading agricultural products in a large number of countries worldwide. For the majority of the population, they are still the main food. Over 50% of the energy value of an average daily world meal in the population's diet is provided by this product group. Apart from a high share they have in the population's diet, cereals represent the basis for the development of intensive cattle production, and are also a significant industrial raw material (Đorović et al., 2006:93). In a large number of countries throughout the world, wheat and corn have a significant place in the structure of areas under cereals.

Traditionally, wheat and corn were deemed synonymous for predominantly natural crop cultures. On rural estates, people primarily satisfied their needs for bread grains while its market orientation only sporadically appeared in fertile years. Together with economic development and the growth of labor productivity, wheat and corn become market products. So, wheat and corn gradually move from smaller to bigger estates and regions with more favorable natural conditions. That is a precondition for regional allocation and labor distribution.

Together with changes in economic development, the structure of sowed areas, the volume of wheat and corn production and their yields per hectare are also significantly changing. Once deficient products, wheat and corn are now becoming surplus products in Serbia.

In the time period between 1976 and 2010, areas under **wheat** reduced by 38% (from 853.0 thousand ha to 527.7 thousand ha), the volume of production reduced by 39% (from 3.1 mill. tons to 1.9 mill. tons), and yield reduced by 3% (from 3.7 t/ha to 3.6 t/ha). However, after the year 1990, the average yield of wheat reduced from 4.2 to 3.6 t/ha [6] (the time period between 2006 and 2010), whereas the volume of production fell from 3.1 million tons to 1.9 million tons in the time periods 1986-1990 and 2006-2010, respectively. In the time period between 1976 and 2010, the average annual rate of the reduction of areas under wheat was -1.82%, production -2.20% and yields -0.39%.

So, having once been a surplus country, Serbia came closer to the bottom limit of self-sufficiency in wheat production. Because of big oscillations in production, certain wheat export quotas cannot be counted on. That significantly mitigates Serbia's competitiveness[7] in exporting wheat onto the foreign market.

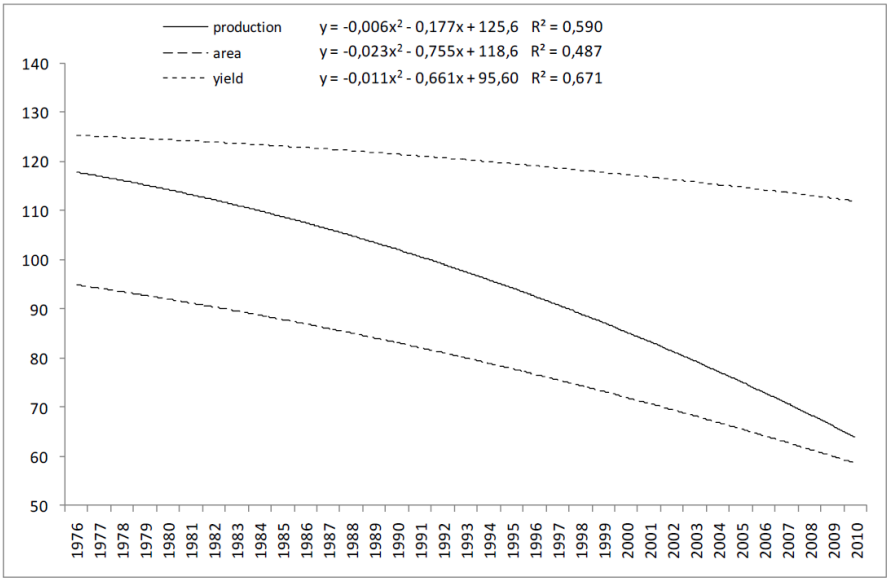
6 Wheat genetic potentials are over 10 t/ha and those of corn are over 15 t/ha.

7 Countries sporadically exporting products obtain lower exporting prices than countries with permanent quotas for the export of a product.

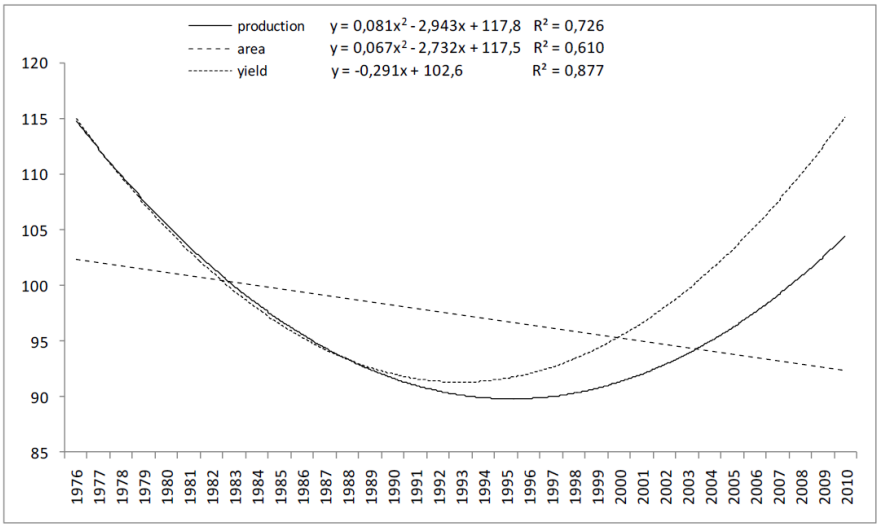
Differently from wheat, after the year 1995, **corn** recorded a 6% reduction of sowed areas. By the 15% reduction in the volume of corn production in the time period from 1986 to 1990, the production today is at the level it had in the 1970's, which is around 5.9 mill. t. However, yields of corn are by 7% higher than they used to be in the 1970's and are around 4.9 t/ha. The annual rate of the reduction of areas under corn was 0.31% whereas the production rate increased at the rate of 0.56% and the yields rate at 0.87%.

Chart 1. Wheat and corn production, areas and yields indices in the Republic of Serbia in the time period from 1976 to 2010

Wheat



Corn



The reduction of areas and an increase in corn production, as the result of the increase in yields per ha, represent a legal tendency of the overall development of the country. In the time period to come, a similar tendency can be expected in wheat production as well.

Table 1. The degree of the marketability, production, areas and yields of wheat per districts in Serbia in the year 2009

	Production marketability		Production		Area		Yield	
	Market surplus 000 t	Market-ability degree %	000 t	%	000 ha	%	t/ha	Index Serbia =100
Republic of Serbia	990.9	47.93	2067.6	100.0	567.7	100.0	3.64	100.0
Central Serbia	138.3	15.79	876.1	42.4	266.0	46.9	3.29	90.4
AP Vojvodina	852.6	71.56	1191.4	57.6	301.7	53.1	3.95	108.4
Belgrade-City district	-104.7	-98.15	106.7	5.2	28.9	5.1	3.69	101.4
North Bačka district	85.6	71.29	120.1	5.8	31.1	5.5	3.86	105.8
Middle Banat district	151.8	76.79	197.7	9.6	53.1	9.4	3.72	102.1
North Banat district	69.7	70.06	99.5	4.8	31.1	5.5	3.20	87.8
South Banat district	147.0	73.24	200.7	9.7	51.5	9.1	3.90	106.9
West Bačka district	126.3	74.70	169.1	8.2	39.0	6.9	4.34	119.2
South Bačka district	157.0	67.15	233.8	11.3	54.2	9.5	4.32	118.5
Srem district	115.3	67.54	170.7	8.3	41.6	7.3	4.10	112.6
Mačva district	32.4	36.70	88.3	4.3	25.4	4.5	3.48	95.6
Kolubara district	3.0	9.12	32.9	1.6	11.2	2.0	2.93	80.5
Danube district	21.6	43.35	49.9	2.4	13.7	2.4	3.65	100.3
Braničevo district	45.0	51.21	87.9	4.3	27.3	4.8	3.22	88.4
Šumadija district	34.9	50.35	69.4	3.4	19.1	3.4	3.64	99.9
Morava district	19.3	37.60	51.5	2.5	13.5	2.4	3.82	104.9
Bor district	27.5	49.61	55.5	2.7	17.2	3.0	3.22	88.5
Zaječar district	19.5	41.39	47.1	2.3	15.5	2.7	3.05	83.6
Zlatibor district	-23.8	-299.86	7.9	0.4	2.8	0.5	2.86	78.6
Moravica district	-2.1	-10.28	20.5	1.0	6.3	1.1	3.28	90.0
Raška district	-11.3	-72.52	15.6	0.8	5.0	0.9	3.14	86.3
Rasina district	8.2	19.50	41.8	2.0	11.9	2.1	3.51	96.3
Nišava district	25.6	39.00	65.7	3.2	21.3	3.7	3.09	84.8
Toplica district	14.4	48.09	30.0	1.4	11.2	2.0	2.67	73.4
Pirot district	6,2	31.98	19.4	0.9	6.2	1.1	3.15	86.4
Jablanica district	18,9	35.57	53.3	2.6	18.6	3.3	2.86	78.5
Pčinja district	3,5	10.77	32.9	1.6	11.2	2.0	2.94	80.7

Source: Republican Agency for Statistics, Belgrade

Wheat and corn are the most widespread crop cultures in Serbia. In the structure of sowed areas in the year 2009, wheat and corn had a share of 17.2% and 36.6%, respectively.

Table 2. The degree of the marketability, production, areas and yields of corn per districts in Serbia in the year 2009

	Production marketability		Production		Area		Yield	
	Market surplus 000 t	Market-ability degree %	000 t	%	000 ha	%	t/ha	Index Serbia =100
Republic of Serbia	3999.5	62.53	6396.3	100.0	1208.6	100.0	5.29	100.0
Central Serbia	758.8	31.67	2396.0	37.5	530.9	43.9	4.51	85.3
AP Vojvodina	3240.7	81.01	4000.3	62.5	677.8	56.1	5.90	111.5
Belgrade-City district	125.5	46.07	272.3	4.3	54.2	4.5	5.03	95.0
North Bačka district	390.2	86.93	448.9	7.0	77.2	6.4	5.82	109.9
Middle Banat district	423.7	82.31	514.7	8.0	88.2	7.3	5.84	110.3
North Banat district	283.7	83.49	339.8	5.3	70.5	5.8	4.82	91.1
South Banat district	720.2	79.68	903.9	14.1	146.5	12.1	6.17	116.6
West Bačka district	390.9	81.97	476.8	7.5	76.9	6.4	6.20	117.2
South Bačka district	510.5	77.58	658.1	10.3	105.8	8.8	6.22	117.5
Srem district	521.4	79.22	658.1	10.3	112.8	9.3	5.84	110.3
Mačva district	126.0	35.04	359.5	5.6	70.3	5.8	5.11	96.6
Kolubara district	60.0	38.96	154.0	2.4	32.9	2.7	4.68	88.4
Danube district	61.8	39.31	157.1	2.5	38.9	3.2	4.04	76.3
Braničevo district	127.7	50.50	252.8	4.0	60.9	5.0	4.15	78.5
Šumadija district	77.4	43.21	179.0	2.8	35.6	2.9	5.02	94.9
Morava district	114.2	48.88	233.6	3.7	52.4	4.3	4.46	84.2
Bor district	-4.6	-7.25	63.9	1.0	16.9	1.4	3.78	71.5
Zaječar district	7.7	9.63	80.0	1.3	18.8	1.6	4.26	80.5
Zlatibor district	-5.9	-20.92	28.4	0.4	8.4	0.7	3.40	64.2
Moravicadistrict	20.6	28.47	72.4	1.1	15.7	1.3	4.62	87.2
Raška district	18.2	27.13	67.2	1.1	13.3	1.1	5.06	95.6
Rasina district	41.1	25.05	163.9	2.6	32.4	2.7	5.06	95.6
Nišava district	7.7	6.23	123.2	1.9	30.4	2.5	4.05	76.5
Toplica district	-2.7	-6.34	42.6	0.7	11.5	1.0	3.69	69.8
Pirot district	0.4	1.50	26.9	0.4	7.0	0.6	3.85	72.8
Jablanica district	-8.2	-9.54	85.9	1.3	21.2	1.8	4.06	76.7
Pčinja district	-9.7	-29.27	33.3	0.5	10.2	0.8	3.26	61.7

Source: Republican Agency for Statistics, Belgrade

The marketability of wheat production significantly fell from 46.7% to 27.4%. Around 27% was sold and bought, while an extremely small amount of around 0.2% of the total production was traded in the farmers' market. Also, the marketability of corn production significantly declined from 10.8% to 6.9%. An extremely small amount of production, around 7%, was sold and bought, whereas around 0.3% was traded in the farmers' market (Đorović, Stevanović, 2006:216).

However, there are differences in the degree of wheat and corn production marketability, both per macro-regions in Serbia and per analyzed districts. In 2009, the marketability of wheat and corn production was 47.9% and 62.5%, respectively. In AP Vojvodina, there

was 71.6% marketability and in Central Serbia it was only 15.8%. Differences between different districts are also present in corn production marketability. Namely, the degree of corn marketability is 81.0% in Vojvodinaand31.7% in Central Serbia.

There are also big differences in the wheat and corn production volume per districts in Serbia. In Vojvodina in the year 2009, 57.6% and 62.5% of wheat and corn, respectively, was produced, and Central Serbia only produced 42.4% and 37.5% of wheat and corn, respectively. (Tables 1 and 2)

Apart from Belgrade, the wheat production deficit in the year 2009 was recorded in only three more districts (Zlatibor, Moravica and Raška districts). In three districts (South Bačka, South Banat and Middle Banat districts) in Vojvodina, almost 30% of wheat production was realized. Exactly in those districts, the yield of wheat per ha, higher by around 18%, was achieved, in comparison with the average yield in Serbia.

Apart from Belgrade, the corn production deficit in the year 2009 was recorded in five more districts (Bor, Zlatibor, Toplica, Jablanica and Pčinja districts) in Central Serbia. Similar to wheat, one-third of corn production was generated from three districts (South Banat, Srem and South Bačka districts) in Vojvodina. In these districts, the yield of corn per ha was 10-18% higher than the average one in Serbia.

The said data are implicative of the fact that there is a high degree of the Vojvodina-based wheat and corn production concentration. Comparative natural conditions and soil fertility are crucial factors having an impact on the degree of the marketability, volume of production and yields of wheat and corn in Serbia.

The cluster analysis of the production of wheat and corn in Serbia

The ranking of the wheat and corn production districts according to the three groups of characteristics (land capacities, production and the level of development) was conducted by calculating the value of Ivanović's distance (the I-distance) for each group of the observed characteristics. Beginning with the fact that the x2 characteristic – the share of plough-fields and gardened areas in arable areas – is the most significant for the land capacities characteristics group, x12 – the production of corn in tons – for the production characteristics group, and x14 – NI/capita – for the development level characteristics group, and applying the I-distance, we obtain the rank of the district according to the analyzed groups of characteristics accounted for in Table 3.

On the basis of Pearson correlation coefficients [8] a fact was established that the highest interdependence is between land capacities and wheat and corn production, while lower interdependences are those between land capacities and NI/capita, on the one hand, and production and NI/capita, on the other.

8 The interdependence of the characteristics is presented by the following simple correlation coefficients: the share of arable areas/wheat production=0.74066; the share of arable areas/corn production=0.77329; the share of arable areas/NI per capita=0.54792; wheat production/NI per capita=0.50984; corn production/NI per capita=0.54167.

Table 3. Serbia's districts ranked according to the I-distance

Districts	Land capacities characteristics		Production characteristics		Development level characteristics	
	Rank	I-distance	Rank	I-distance	Rank	I-distance
Middle Banat district	1	8.725139	5	2.43352	14	3.1480206
Nišava district	2	8.318207	19	0.36659	22	1.7062749
Jablanica district	3	8.147144	21	0.26158	25	1.2822662
West Bačka district	4	8.125168	4	2.46210	2	5.7529503
Toplica district	5	8.103151	20	0.29962	17	2.6969238
South Bačka district	6	7.808574	6	1.61212	3	5.3628713
Bor district	7	7.550212	16	0.42299	23	1.6602400
Zaječar district	8	7.422552	18	0.37977	19	2.2478261
North Bačka district	9	7.337999	1	4.38477	8	4.3715092
Srem district	10	6.710838	3	2.67103	11	3.9550674
Pirot district	11	6.646724	23	0.08547	16	3.0682153
North Banat district	12	6.615866	8	1.06261	5	5.0902642
Braničevo district	13	6.415211	11	0.82677	24	1.6340842
Šumadija district	14	6.035178	12	0.71282	10	3.9638245
Belgrade-City district	15	5.763625	15	0.43347	1	8.3013425
South Banat district	16	5.561612	2	3.04592	12	3.5689450
Danube district	17	5.340989	7	1.51235	13	3.2734715
Rasina district	18	5.082056	13	0.65420	15	3.0906051
Mačva district	19	5.043823	10	0.97339	21	1.8671706
Pčinja district	20	4.819132	24	0.04006	20	2.0625844
Morava district	21	4.220196	9	1.04878	7	4.6400077
Kolubara district	22	4.081857	14	0.51561	18	2.4864300
Moravica district	23	2.323572	17	0.39704	4	5.2486455
Raška district	24	1.679082	22	0.11322	6	4.6723868
Zlatibor district	25	0.224578	25	0.02729	9	4.2538279

On the basis of the rank of the districts according to the I-distance, there are two tendencies. First, the five districts of Central Serbia (Nišava, Jablanica, Toplica, Zaječar and Pirot districts), although belonging to the high rank (1-11) of available land capacities, realize the low volume of wheat and corn production (Ranks 19-23) and belong to the low rank (16-25) of the development level. Contrary to them, the second three districts in Vojvodina (North Bačka, Srem and South Banat districts) are highly ranked (1-3) from the standpoint of the production characteristics, although they are of the low land capacities characteristics rank (Ranks 9-16) and at the average level of the development characteristics (Ranks 8-12). Apart from their available land capacities, the mentioned

districts of the south-eastern part of Central Serbia have a low volume of wheat and corn production because of unfavorable comparative natural conditions for their production. Differently from them, the districts in Vojvodina have comparative natural conditions for the production of wheat and corn, so, even though they have a lower rank when available land capacities are concerned, they have a high production volume rank. Simultaneously, other crop cultures [9] have a high share in the structure of plough-fields areas in the mentioned districts in Vojvodina.

According to the development level characteristics, the districts belonging to Ranks 1-5 (Belgrade-City, West Bačka, South Bačka, Moravica and North Banat districts) are in Vojvodina, except for Belgrade-City and the Moravica districts. Vojvodina's districts are highly ranked when the land capacities (Ranks 4, 6 and 12) and production characteristics (Ranks 4, 6 and 8) are concerned.

On the dendrogram (Chart 2), 3 clusters (groups) of districts producing wheat and corn in Serbia can be identified. The first cluster includes 4 districts, the third cluster includes 5, and the second cluster includes the largest number of districts – 16 districts classified into three sub-clusters (the first cluster – 5, the second cluster – 6 and the third cluster – 5 districts).

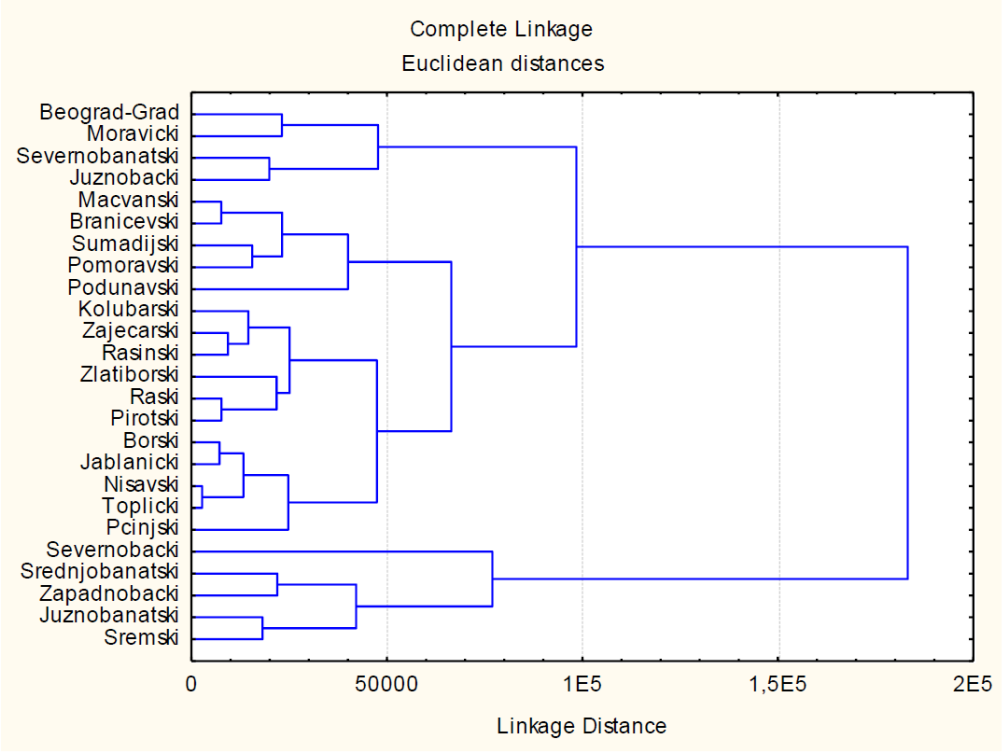
The first cluster includes 2 districts from Central Serbia (Belgrade-City and Moravica districts) and 2 from Vojvodina (North Banat and South Bačka districts). The districts of this cluster belong to the most developed (characteristics x_{14}-x_{17}) regions in Serbia (Belgrade-City district Rank 1, South Bačka district Rank 3, Moravica district Rank 4 and North Banat district Rank 5) with a low percentage of the share of agriculture in the NI structure and, with Belgrade as an exception, a relatively high percentage of agricultural population in the total population. According to available land resources (characteristics x_1-x_5), the districts in Vojvodina are more highly ranked if compared with the districts in Central Serbia. Namely, the districts of South Bačka and North Banat belong to Ranks 6 and 12, while Belgrade-City and Moravica districts belong to Ranks 15 and 23. According to the characteristics of the production (characteristics x_6-x_{13}) of wheat and corn, South Bačka and North Banat districts belong to Ranks 6 and 8. These districts have a high degree of the marketability of the production of wheat and corn. According to the production characteristics, Belgrade-City and Moravica districts belong to the second half of the district ranking list (Ranks 15 and 17).

The second cluster includes the largest number of districts (sixteen districts) in Central Serbia, classified into three sub-clusters. The first sub-cluster includes five districts (Mačva, Braničevo, Šumadija, Morava and Danube districts), the second one – six districts (Kolubara, Zaječar, Rasina, Zlatibor, Raška and Pirot districts), and the third one – five districts (Bor, Jablanica, Nišava, Toplica and Pčinja districts). ***The first sub-clusteris (pk1)*** characterized by a low share (Ranks 10-24)of areas under wheat and a high share (Ranks 1-10, except for Šumadija district Rank 16) of areas under corn in the structure of areas under cereals. According to the degree of the market production of wheat and

9 Sugar-beet, sunflower, oil rape, soya and so on.

corn, they are within ranks 8-17 and 9-14, respectively. Braničevo district is the most developed [10] (Rank 16) district in this cluster, with almost the biggest share of agriculture in the NI structure (Rank 2) and the percentage of agricultural population (Rank 1), whereas Šumadija district is the most developed (Rank 9) district of this sub-cluster. According to the land capacities characteristics, the districts of this sub-cluster are ranked from 13-Braničevo district to 21-Morava district; according to the production characteristics, they are ranked from 7-Danube district to 12-Šumadija district; and according to the development level characteristics, they rank from 7-Morava district to 24-Braničevo district. ***The second sub-cluster is (pk2)*** characterized by the low rank of the land capacities characteristics (18-25), except for Zaječar district (Rank 8) and Pirot (Rank 11) district, then a low rank of the production characteristics (Ranks 18-25), with an exception of Rasina district (Rank 13) and Kolubara (Rank 14) district, as well as the low rank of the development characteristics (Ranks 15-19), except for Raška (Rank 6) and Zlatibor

Chart 2. A dendrogam of the production of wheat and corn as per districts in the Republic of Serbia



(Rank 9) districts. Zaječar (Rank 4) and Pirot (Rank 5) districts have a high share of areas under wheat, while Kolubara (Rank 5) district has a high share of areas under corn in the structure of cereals. The marketability of the production of wheat and corn of this sub-cluster is ranked 16-25 and 15-24, respectively. According to the NI/capita, Zlatibor

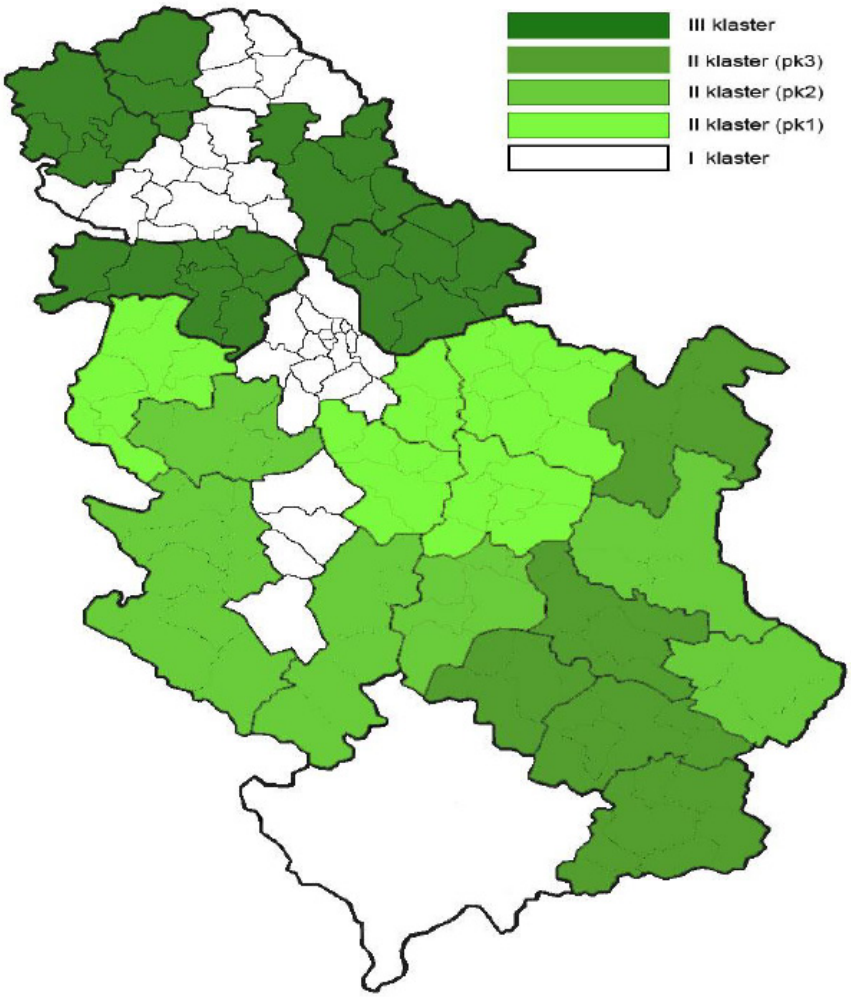
10 According to the amount of NI/capita

district is the most developed district (Rank 12), whereas Pirot district is the most undeveloped (Rank 20) district of this cluster, with a high (Rank 6) share of agriculture in the structure of the NI of the economy and a high (Rank 2) percentage of agricultural population in the total population. ***The third sub-cluster (pk3)*** is characterized by a high share of areas under wheat (Ranks 1-6), except for Pčinja district (Rank 11), and a low share of areas under corn (Ranks 19-25) in the structure of areas under cereals. Apart from Pčinja district (Rank 20), the districts of this sub-cluster belong to Ranks 2-7 according to the land capacities characteristics, and according to the production characteristics they are ranked between 16-Bor district and 24-Pčinjadistrict. The similar situation is with the development level characteristics, where they are ranked from 17-Toplicadistrict to 25-Jablanicadistrict. The degree of the marketability of the production of wheat and corn belongs to Ranks 8-17. According to the amount of the NI/capita, the districts of this sub-cluster are the most undeveloped in Serbia and belong to Ranks 21-25, having a high share of agriculture in the structure of the NI (Ranks 18-22, with the exception of Pčinja-10 and Toplica-12 districts) and the structure of agricultural population (Ranks 15-20, except for Bor district Rank 4 and Toplica district Rank 7) in the total population.

The third cluster includes 5 districts of Vojvodina (North Bačka, West Bačka, Middle Banat, South Banat and Srem districts). These are typically agricultural districts with a very high share of arable (Ranks 1-4) areas in agricultural areas, with South Banat (Rank 10) and Middle Banat (Rank 18) districts as exceptions. North Bačka, Srem and South Banat districts are typically corn-oriented (Ranks 2, 4 and 9), whereas in Middle Banat district wheat (Rank 7) is more present in the structure of cereals if compared with corn (Rank 14). According to the land capacities characteristics, Middle Banat district belongs to Rank 1, and West Bačka district to Rank 4, whereas the other districts belong to Ranks 9-16. However, according to the wheat and corn production and degree of their marketability characteristics (the characteristics x6-x13), these districts are top ranked (Ranks 1-5). Bačka districts (West Bačka and North Bačka districts) are more developed (Ranks 2 and 4) and have a relatively low share of agriculture in the structure of the NI (Ranks 8 and 16) and in the share of agricultural population in the total population (Ranks 5 and 11) as compared to Banat districts (Middle Banat and South Banat districts) which, according to the level of the NI per capita, belong to Ranks 7 and 8, according to the share of agriculture in the NI they belong to Ranks 23 and 28, and according to the share of agricultural population in the total population they are ranked 21 and 18.

So, even though North Bačka, Srem and South Banat districts have relatively lower ranks from the viewpoint of available land capacities (Ranks 9-16), the third cluster districts are still characterized by a high volume of wheat and corn production and a high degree of their marketability (Ranks 1-5). That is implicative of the fact that, in these districts, there are comparative advantages for the production of wheat and corn in comparison with some other districts of Central Serbia which, apart from the highly-ranked land capacities characteristics, still have a lower rank of the production characteristics.

Cartogram 1. Clusters of the production of wheat and corn in Serbia



The mentioned regional differences from the standpoint of land capacities, the volume of production and the development level have an influence on the presence of cattle production, too, especially pig-breeding, traditionally connected with corn production. The relatively low corn production marketability is connected with the fact that, to a great extent, corn is used as animal feed on rural estates. For that reason, the marketability of corn production can here be observed indirectly via cattle breeding and meat production. Given this fact, it is possible to consider two forms of the marketability of corn production when it is analyzed: first, there is direct marketability achieved through the market realization of corn, and second, indirect marketability achieved through the marketability of cattle products (Stevanović, 2002:287).

Conclusion

Wheat and corn are the most widespread crop productions present in all districts in Serbia. Even though they are present to a great extent, there is still reduction in areas under wheat and corn, which is an expected and positive tendency. However, yields per ha are unjustifiably low and are significantly smaller in comparison with yields in developed countries. By increasing the volume of production, accompanied by changes in economic development, the degree of the marketability of wheat and corn also increases. The increase in marketability is the result of the relocation of production from smaller to bigger estates and regions with more favorable natural conditions, which represents the regional allocation and specialization of these productions. That has a two-fold effect: on the one hand, it positively impacts the producer's profit, and, on the other, it impacts rural poverty reduction. If we have in view the fact that there is increased demand in the world, then there is no justification for negative tendencies in the production of wheat and corn in Serbia.

In Serbia, there are two groups of districts of the producers of wheat and corn. The first is the group of undeveloped districts belonging to a high rank of the land capacities characteristics but achieving a low volume of wheat and corn production, and the second one, the group of relatively developed districts achieving a high level of production volume although they have a low rank of the land capacities characteristics. The districts in the first group are located in South-East Serbia, whereas those in the second group are mainly located in Vojvodina, and, in comparison with Central Serbia's districts, have comparative natural conditions for the production of wheat and corn.

Changes made during the transition process all the more justify the researching of this theme intended to gain an insight into the possibilities, directions and manners of a faster development of agriculture in a market ambience. The development of market production provides preconditions for the accelerated economic progress of Serbia's economy.

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RAZVOJ TRŽIŠNE PROIZVODNJE ŽITA U SRBIJI: PRIMER PŠENICE I KUKURUZA[11]

Simo Stevanović [12], Milutin Đorović [12], Milan Milanović [13]

Rezime

U radu su istraživane tendencije u razvoju proizvodnje pšenice i kukuruza u period od 1976. do 2010. godine, sa težištem na klaster analizi tržišne proizvodnje ovih proizvoda po okruzima u Srbiji 2009. godine. Na osnovu važnijih obeležja raspoloživih zemljišnih kapaciteta, obima proizvodnje i privredne razvijenosti, metodom I – odstojanja izvršeno je rangiranje okruga. Rangiranje okruga prema analiziranim obeležjima izvršeno je na osnovu medijalne vrednosti podataka po opštinama. Za svako od navedenih grupa obeležja, I-odstojanjem izvšeno je rangiranje okruga od 1-25, pričemu je rang 1 najbolji, a rang 25 naj lošiji. Sličnosti okruga prema analiziranim obeležjima predstavljene su metodom kompletnog povezivanja hijarhijske klaster analize, a rezultati su predstavljeni dendrogramom i kartogramom.

Pored povoljnih uslova (zemljišnih, klimatskih, itd.), tradicionalne navike proizvođača unajvećoj meri su uticali na neopravdano visoku zastupljenost pšenice i kukuruza u strukturi ratarske proizvodnje. To je, uvelikoj meri, uticalo i na visoku tržišnost proizvodnje pšenice i kukuruza u Srbiji.

Ključne reči: *tržišna proizvodnja, pšenica, kukuruz, I-odstojanje, klaster analiza.*

11 Rad predstavlja deo istraživanja na projektu „Ruralno tržište rada i ruralna ekonomija Srbije-diverzifikacija dohotka i smanjenje siromaštva“, br. ON179028, koji u periodu 2011-2014 godine finansira MNTR Vlade Republik Srbije.

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