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FARM STRUCTURE AND FARMLAND CONCENTRATION IN ROMANIA AND IN OTHER SELECTED EU'S COUNTRIES WITH LARGE UTILIZED AGRICULTURAL AREA

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Abstract

The present paper aimed to analyze utilized agricultural area (UAA), number of agricultural holdings (NAH), average holding size (AHS), standard output per holding (SOH) in Romania and other EU countries with large UAA in the period 2005-2020 using the data from Eurostat and National Institute of Statistics in order to identify the trends and actual situation. Fixed basis indices, regression equations, R square, Herfindahl-Hirschman Index (HHI), Gini Struck Coefficient(GSC), structural indices, comparisons with the EU average and among the selected EU countries: Romania, Poland, Italy, Spain, France, Germany, United Kingdom were used as processing methods for reflecting the changes farmland and farm structures. In 2020, Romania had 12,763 thousand ha UAA, representing 7.6% of the EU's UAA and coming on the 6th position, after France, Spain, Germany, Poland and Italy. In 2020, Romania had 2.88 million AH and together with Poland, Italy, Spain, France and Germany, had 6.89 million AH (75.7% of the EU's 9.1 million NAH). The farms smaller than 5 ha represent: 90.3% in Romania, 64.1% in Italy, 52.3% in Poland, 51.6% in Spain, 19.6% in France and 8.2% in Germany, while the farms with 50 ha and over account for 7.5% at the EU level, 1% in Romania, 3.1% in Poland, 4.5% in Italy, 11.6% in Spain, 31.5% in Germany and 45.9% in France. To the EU's SO, all these six countries contribute by 71% to the EU's SO. In the EU, less than Euro 2,000 SO was produced by 35.7% farms, while Euro 50,000 and over was achieved by 12.9% farms. In Romania, 71.5% farms produce less than Euro2,000, while 0.9% achieve Euro 50,000 and over. Regarding the concentration of farms by SO size class, HHI and GSC reflected a high concentration in Romania, relatively moderate at the EU level, moderate in Poland and Italy, and a lack of concentration in Spain, France and Germany. The SO/AH in Romania was Euro 4,029, compared to Euro 38,703 at the EU level, Euro 19,680 in Poland, Euro 57,681 in Italy, Euro 44,124 in Spain, Euro 158,430 in France and Euro 167,631 in Germany. As a final conclusion, the gaps among these countries are caused by the unbalanced farm structure with the highest share belonging to the farms with less than 2 ha. Farms with 50 ha and over could assure a higher SO/farm. To diminish NAH and grow AHS has to continue for increasing the economic power in terms of standard output. Small and medium-sized farms have to be sustained to join their efforts for a higher concentration of land, production and economic efficiency.

Key words**:** *utilized agricultural area, agricultural holdings, standard output, concentration, Romania, European Union*

INTRODUCTION

Global agriculture is sustained by small farms, reflecting their role in human life, poverty reduction, biodiversity and environment conservation.
However, small agribusiness is facing various barriers which affect profitability and future development, as long as the financial support is mainly oriented to commercial large farms. That is why, small farmers should be encouraged and sustained to become more involved in the economic and social development, as well as in environment preservation [20, 21, 26].
It is unanimously recognized that the EU agriculture is also characterized by small farming, as long as in 2020, the average farm size was 17.4/ha per farm, and this highlights the role of small farmers in the EU food

system, in rural development assuring jobs and income for local population, producing healthier products and preserving regional specificity by using traditional technologies, contributing to environment quality, biodiversity and landscape maintenance [6, 40].

The general trend across the time, and mainly in the last two decades, was the disappearance of millions of small farms in the EU due to the market pressure, the negative effects of climate change, lack of financial resources to improve technologies and invest in innovation, farmers' aging and migration of young people to cities [1].

These aspects have been noticed in many EU countries, including Romania [34].

A new reform in the EU CAP recently adopted pays more attention to small farmers and provides important measures for sustaining small agribusiness.

Farm structure is very diverse from a country to another and in each member state from a region to another [3, 7, 8, 27].

Farm size is a key indicator which reflects resources, inputs, output and profitability. The size of a farm depends on land ownership, technical endowment, applied technologies, farmer's age and training level, and opportunities to sustain agribusiness [27].

The growth in farm size is closely connected to the decline rate in the number of farms and the capacity of larger farms to acquire the remaining farm land [2, 23].

Farm size could be expressed in terms of land area per farm or in livestock units (LU/farm), labour force, farm inputs and products sales, but the key measure is "land surface" considered an universal tool which allows the comparison between farms, regions and countries all over the world [22].

However, the EU established a new indicator which allows to assess the agricultural economic output, named "standard output-SO", considered more effective for expressing the economic power of a farm.

Standard output is "the average monetary value of the agricultural output at farm gate price, in Euro/ha or per head LU." For each regional product, the EU established a "regional SO coefficient, as a mean value over a reference period of five years. The sum of all the SO per ha or LU in a farm is at present a measure of its overall economic size in Euro".

At present, agricultural holdings are classified by SO and also by type of farming in the EU [16, 19].

Farm size is linked to agriculture profitability and to increase farm size is a goal to grow farmer's profit, but also the economic, social and environmental effects [38].

Farm size and productivity vary at the global level and has a high importance for economic development, poverty reduction, food production and environment protection [39].

The EU has a large variety of countries regarding utilized agricultural land (UAA), number of agricultural holdings (NAH) and their size in ha/farm and in SO/farm, and of course, a diverse contribution of its member states to the EU agricultural economic output.

In the EU, there are a few countries working large surfaces of agricultural land, which in the decreasing order are: France, Spain, Germany, Poland, Italy and Romania, all together using 68.6% of the EU UAA, which in the year 2020 was 157.4 million ha [17,18].

These countries cultivate relatively similar agricultural crops, and this was the reason why Greece is not included to this group despite it has a large UAA.

Regarding NAH, Romania is on the top position with 2.88 million farms, being followed by Poland and Italy, all these three countries summing 5.32 million farms, accounting for 59.% of the EU 9.1 million farms in the year 2020. The other member states Spain, France and Germany with a large UAA have a smaller NAH.

Romania is an important country of the EU and agriculture in this country has an important contribution to GDP [29, 32].

The variability of land policy applied in the EU member states produced important changes in farm structure, both inside each country and at the EU level.

At present, the EU has a large range of farm types, sizes, endowment, productivity, and efficiency [30, 31, 33, 35, 36, 37].

Most of the farms are family subsistence or semi-subsistence small farms [4].

Despite that during the last decades, millions of farms have disappeared, the merge process is running slowly [5].

The EU agriculture is dominated by family farms which in the year 2020 accounted for 94%. In this farms, 50% of labor force is represented by family members. In all the EU member states, family farms are the most numerous of the total NAH [17].

The average farm size at the EU level was 17.4 ha in the year 2020. In the countries mentioned, farms have a different average area, as follows: 69.7 ha/farm in France, 63.17 ha in Germany, 26.12 ha in Spain, 11.36 ha in Poland, 11.06 ha in Italy and 4.42 ha in Romania. But, Czechia and Slovakia occupy the top position in the EU for this indicator.

The average economic size of a farm in the EU is Euro 38.7 thousand, but it varies from a country to another. Regarding the six countries with the largest UAA, SO/NAH in the decreasing order is: Euro 167,631 in Germany, Euro 158,430 in France, Euro 57,681 in Italy, Euro 44,124 in Spain, Euro 19,680 in Poland and Euro 4,029 in Romania [17].

In this context, the purpose of this research was to identify the trends in the dynamics of UAA, NAH, average farm size in terms of UAA/farm and average economic size in terms of Euro SO/farm in the period 2005-2020 in Romania in comparison with the EU average and in the selected EU member states with the large utilized agricultural area, emphasizing the situation in the year 2020, after the recent agricultural census in Romania and the EU.

MATERIALS AND METHODS

In order to set up this paper, the data were collected for the period 2003-2020 from Eurostat Database and National Institute of Statistics.

The following indicators were taken into consideration to characterize farm and agricultural land concentration:

(i)Utilized agricultural area (UAA) which was analyzed in its dynamics in Romania, both at the country level and in the territory by the 8 micro-regions of development and also in the EU, pointing out the share of Romania's UAA in the EU's UAA and in the selected member states with the largest UAA: France, Spain, Germany, United Kingdom, Poland, Italy.

(ii)Number of agricultural holdings (NAH) which was analyzed in its dynamics in Romania and also by micro-region of development and also in the EU, pointing out the share of Romania's NAH in the EU's NAH and in the selected member states with the largest UAA.

(iii)Average holding size (AHS) was analyzed in its dynamics in Romania and by micro-region in the territory, and at the EU level and in the selected member states.

(iv)Farm structure by UAA size class in Romania and the EU selected member states, pointing out the share of the farms and their share in UAA by UAA size class;

(v)Farm structure by standard output class in Romania and the EU selected member states, pointing out the share of the farms by each SO size class;

(vi) Standard output in Romania and EU and also in the selected member states by SO size class.

(vii)Standard output per agricultural holding (SO/AH) in its dynamics in Romania and EU and in 2020 in the selected member states, and also by SO size class.

As methodological tools to process the data, there were used the following ones:

-Fixed basis indices, whose formula is:

$I_{FB}=(y_t/y_0)*100$ ..... (1)

-Average growth rate, having the formula:

$\bar{R}_a = (\sqrt[n-1]{\frac{y_n}{y_0}} - 1)*100$ .....(2)

- Trend method using the linear regression function according to the formula:

$\widehat{yt}= bt + a$ ..... (3)

-Herfindahl-Hirschman Index, HHI, for reflecting the degree of concentration regarding UAA, NAH, and SO/AH and SO size class, using the formula:

$HHI_j= \sum_{i=1}^{n} g_i^2$ .....(4)

-Gini-Struck Coefficient, also for assessing the concentration degree, using the formula:

$GSC= \sqrt{\frac{n\sum_{i=1}^{n} g_i^2 - 1}{n-1}}$ ..... (5)

-The graphical method to illustrate the results for a better understanding.
-Comparison method to show the differences between the analyzed indicators in Romania versus EU level and also in the other selected member states.

RESULTS AND DISCUSSIONS

Utilized agricultural area (UAA)

Of Romania's total area of 23,839,071 ha, 61.29% represents agricultural surface. However, only 53% of the whole territory, that is 12,763 thousand ha is utilized for agriculture as reflected by the statistical data [24].
During the period 2003-2020, the utilized agricultural area (UAA) registered a decreasing trend from 13.93 million ha in 2003 to 12.08 million ha in the year 2020, when it was by -13.3% smaller than at the beginning of the interval [25].
As a result, the share of UAA in Romania's surface also decreased from 58.43% in 2003 to 53.53% in 2020.
The tendency is similar with the one observed at the EU level, where UAA declined by 17.3 million ha (9.9%) from 174.7 million ha in 2003 to 157.4 million ha in the year 2020 [17].
In this case, Romania's UAA share in the EU UAA decreased from 7.97% in 2003 to 7.67% in 2020, meaning by -0.3 percentage points less (Figure 1).

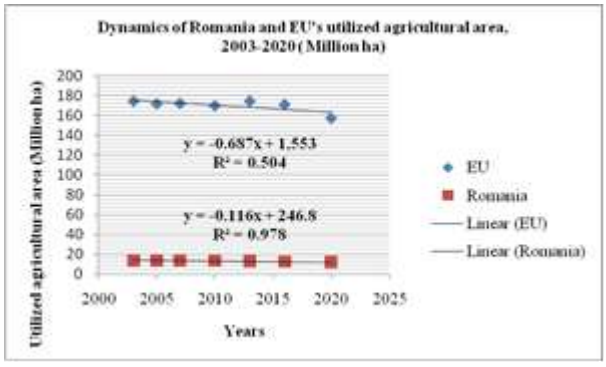

Fig. 1. Dynamics of utilized agricultural area in Romania and in the EU, 2003-2020 (Million ha)
Source: Own design based on the data from [5, 10, 17, 25].

The dispersion of UAA by micro-region of development in Romania is different from a region to another. In 2020, the largest UAA meaning 17.89% of the total UAA belonged to South Muntenia region, followed by South East region with 17.03%. The lowest weight, that is 0.62% is kept by Bucharest Ilfov area (Figure 2).

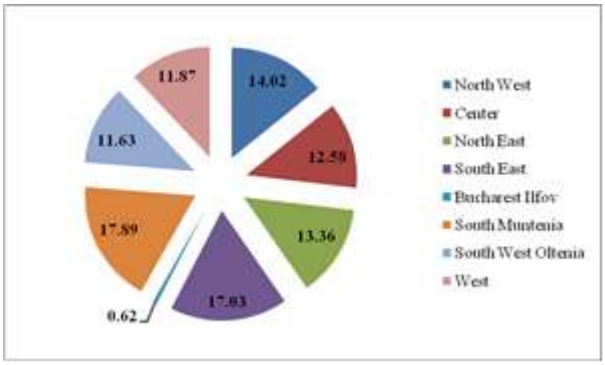

Fig. 2. Dispersion of UAA in Romania's territory by micro region in 2020 (%)
Source: Own design based on the data from [24].

The degree of UAA concentration, expressed as Herfindahl-Hirschman Index, HHI = 0.1447 and Gini-Struck Coefficient, GSC = 0.1500 reflects an unconcentrated surface or, in other words, that there are no significant differences from a region to another.
The UAA is not equally distributed among farms. About 97 % represents the smallest farms with less than 10 ha.
The largest farms with over 50 ha represent less than 0.9 % of the total number of farms, but they are working about 58 % UAA and practice intensive agriculture, producing high quality products and deeply market oriented [35].

Table 1. Dynamics of UAA in Romania compared to the EU' selected countries, 2010-2020 (Million ha)

	2010	2013	2016	2020	2020/2010 %
EU	170.02	174.6	171.28	157.4	92.50
France	27.09	27.74	27.81	27.4	101.14
Spain	23.75	23.30	23.22	23.9	200.63
Germany	16.70	16.70	15.16	16.6	99.40
United Kingdom	15.92	17.32	16.67	-	-
Poland	14.38	14.41	14.40	14.80	102.92
Romania	**13.30**	**13.05**	**12.50**	**12.08**	**90.82**
Italy	12.88	12.09	12.09	12.50	97.04
Total	124.02	124.61	121.85	108.0	87.08
Share in the EU (%)	72.94	71.30	71.14	68.60	

Source: Own calculations based on the data from [17].

Regarding Romani's position in the EU, taking into account the UAA dynamics, the

country has maintained its 6th rank after France, Spain, Germany, United Kingdom, and Poland, being followed by Italy till 2019, and in 2020, after Brexit, it had the same 6th position after France, Spain, Germany, Poland and Italy [28].

If in 2010, the seven selected countries with the largest UAA summed 124.02 million ha, representing 72.94% of the EU's UAA, in the year 2020, the six countries totalled 108 million ha, accounting for 68.6% of the EU's UAA (Table 1).

The number of agricultural holdings (NAH) in Romania followed a continuous decline from 4.5 million in 2003 to 2.88 million in the year 2020, meaning a loss of 1.62 million farms (36%).

This descending trend is similar with the one in the EU where the number of farms decreased from 15.1 million in 2003 to 9.1 million in 2020, showing a loss of 6 million (-59.74%).

In consequence, the share of Romania's farms in the EU's agricultural holdings increased from 29.7% in 2003 to 31.7% in 2020. However, in 2020, the number of Romanian farms was by 0.54 million smaller (-15.8%) from 3.42 million in 2016 to 2.88 million in 2020 (Figure 3).

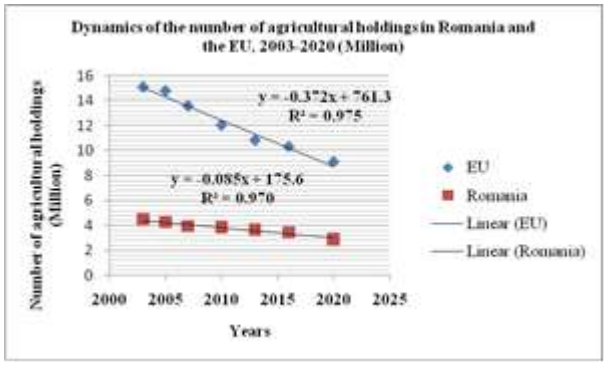

Fig. 3. Dynamics of agricultural holdings in Romania and EU in the period 2003-2020 (Million)
Source: Own design based on the data from [10, 17, 25].

Figure 3 reflects a faster decline rate in the number of agricultural holdings at the EU level than in Romania, where the reduction is still a slow process. The distribution of NAH in Romania's territory, in terms of HHI = 0.1542 and GSC = 0.1826 reflects a moderate concentration of farms. The micro-regions of development with the highest NAH are: North East (20.54%), South Muntenia (18.08%), South West Oltenia (16.18%) and North West (15.34%)/ The lowest share of NAH is in Bucharest-Ilfov (0.59%) (Figure 4).

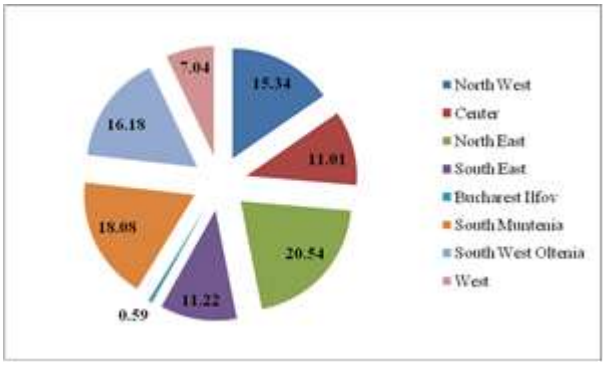

Fig. 4. Fig. 2. Dispersion of the number of agricultural holdings in Romania's territory by micro region in 2020 (%)
Source: Own design based on the data from [24].

After Romania's access into the EU on January 1st, 2007, the country is in the top position for NAH, next to other EU member states with the largest UAA: France, Spain, United Kingdom, Germany, Poland, and Italy.

In Romania, the farms are subsistence and semi-subsistence farms, most of them having below 2 ha, and commercial farms have a very low percentage. The majority of farms have a large variety of scarce resources, mainly agricultural surface, technical endowment, and the results in terms of production performance, productivity and Standard Output as an efficiency barometer are very low [33, 35]. In 2005, Romania, Poland, Italy, Spain, France, Germany and United Kingdom had all together 10.77 agricultural holdings, which represented 74.94% of the EU's NAH. In the year 2020, after Brexit, Romania, Poland, Italy, Spain, France and Germany accounted for 6.89 million agricultural holdings, representing 75.75% of the EU's NAH.

In the period 2005-2020, the number of farms declined in all the selected EU countries, the highest decrease being registered in Poland (-47%), followed by Italy (-34.31%), Germany (-32.65%), France (-30.69%), Romania (-32.4%) and Spain (-15%). At the EU level, the decline in NAH accounted for -36.68% in the interval 2005-2020 (Table 2).

Table 2. Dynamics of the number of agricultural holdings in Romania and in the selected EU countries with the largest utilized agricultural area in the period 2005-2020 (Million)

	2005	2007	2010	2013	2016	2020	2020/2005 %
EU	14.37	13.58	12.05	10.84	10.32	9.1	63.32
Romania	**4.26**	**3.93**	**3.86**	**3.63**	**3.42**	**2.88**	**67.60**
Poland	2.47	2.39	1.50	1.43	1.41	1.31	53.03
Italy	1.72	1.68	1.62	1.01	1.11	1.13	65.69
Spain	1.08	1.04	0.989	0.965	0.945	0.919	85.09
France	0.567	0.527	0.516	0.472	0.456	0.393	69.31
Germany	0.389	0.370	0.299	0.285	0.276	0.262	67.35
United Kingdom	0.285	0.300	0.202	0.185	0.185	-	-
Total	10.77	10.24	8.986	7.975	7.802	6.894	64.01
Share in the EU (%)	74.94	75.40	74.50	73.97	75.60	75.75	-

Source: Own calculations based on the data from: [9, 10, 11, 13, 14, 15, 17].

Average holding size (AHS)

As a result of the decline in UAA and NAH, average holding size (AHS) increased in Romania from 3.1 ha/farm in 2003 to 4.42 ha/farm in 2020, meaning by +42% (Figure 5).

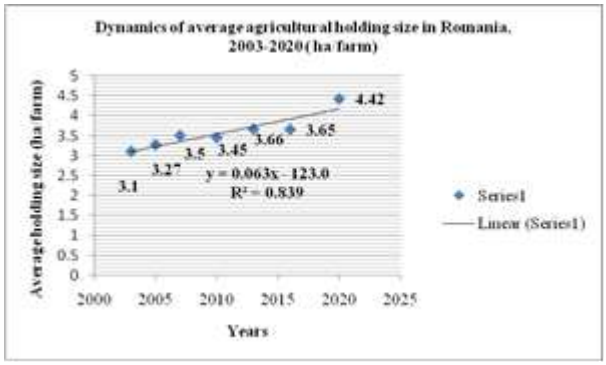

Fig. 5. Dynamics od average agricultural holding size in Romania, 2003-2020 (ha per farm)
Source: Own design based on the data from [25].

The average farm size in Romania is far away from the EU average farm size and in other EU member states.

In the EU, taking into consideration the decline of the UAA and the loss of farms in different countries, the average agricultural holding size increased in the decade 2010-2020 from 14.1 ha/farm to 17.4 ha/farm.

Therefore, if in 2010, AHS in Romania was 3.45 ha/farm, that is 4 times smaller than the EU average, in the year 2020, its size was 4.42 ha, being 3.93 times smaller [17].

In the territory of Romania, the average farm size is enough different from a micro-region to another. The highest AHS is in West region, 7.46 ha/farm and Center, 5.05 ha/farm, while in North East is the smallest AHS, accounting for 3.09 ha and in South West Oltenia, 3.18 ha (Figure 6).

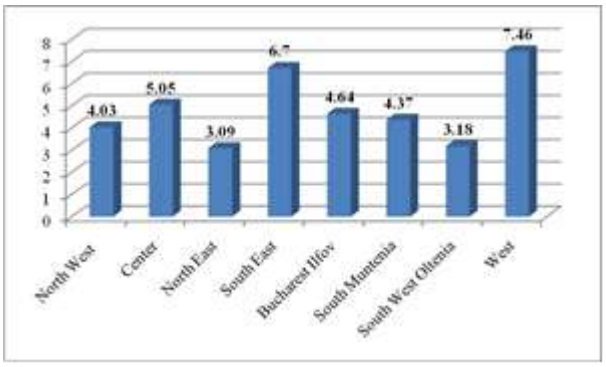

Fig. 6. Dispersion of average agricultural holding size in Romania by microregion in the year 2020 (ha)
Source: Own design based on the data from [25].

At the EU level, the dynamics of AHS reflected a growth rate of 48.71% from 11.7 ha/farm in the year 2003 to 17.4 ha in 2020.

Important growth rates were noticed in the selected EU countries: Poland (+72.12%), Italy (+65.07%), France (+53.86%), Germany (+53.32%) and Spain (+18.19%).

Comparing AHS with the EU average and also in these selected countries, it is easy to notice that AHS in Romania is much smaller than the EU average and in the other countries considered in this study (Table 3).

Romania comes on the penultimate position in the EU, being followed by Cyprus and Malta.

Table 3. Dynamics of average agricultural holding size in Romania compared to the one in the EU and the selected countries in the period 2003-2020 (ha/farm)

Country	2003	2010	2013	2016	2020	2020/2010 %
EU	11.7	14.1	16.1	16.66	17.4	148.71
United Kingdom	57.4	78.6	93.6	99.07	-	-
France	45.3	52.6	58.7	60.9	69.7	153.86
Germany	41.2	55.8	58.6	57.2	63.17	153.32
Spain	22.1	24.0	24.1	24.5	26.12	118.19
Italy	6.7	7.9	12.0	11.97	11.06	165.07
Poland	6.6	9.6	10.1	10.2	11.36	172,12
....						
Romania	**3.1**	**3.4**	**3.6**	**3.66**	**4.42**	**130.00**

Source: Own calculations based on the data from [10, 17].

Farm structure by UAA size class

In the EU, the farm structure by UAA size is very different from a country to another.

Comparing the share of the farms with an UAA smaller than 5 ha and the ones having an UAA of 50 ha and over, we may easily notice that, in 2016, in the EU, the number of farms smaller than 5 ha accounted for 65.4% in the total NAH and 6,1% in the EU total UAA.

The farms with 50 ha and more represented 7% of NAH and 68.1% of EU total UAA.

In 2016, Romania had the most numerous farms smaller than 5 ha in the EU, they accounting for 3.1 million farms, representing 91.8% of NAH in the country and working 28.75 of the country UAA.

The larger farms than 50 ha represented only 0.5% of the total NAH and worked 51.15 of the total UAA.

This is a peculiar situation in Romania and completely different than in all the other EU selected countries as shown in Table 4.

In 2020, Romania had 2.88 milion farms accounting for 31.7% of the EU NAH.

The highest share of 70.76% in Romania's NAH was kept by the farms having less than 2 ha.

The farms between 2 and 4.9 ha represented 18%, the ones with 50 ha and over 0.95%, and the farms with 100 ha and more accounted for only 0.56%.

Therefore, in the EU NAH, Romanian farms below 2 ha accounts for 54.7%, the ones between 2-4.99 ha accounts for 26.97% and the ones for 5-9.99 ha for 14.35%.

Table 4. The share of the smallest farms smaller than 5 ha and of the larger farms than 50 ha in Romania compared to the other EU selected countries in the year 2016 (%)

Country	Share (%) in:	The smaller farms with less than 5 ha	The larger farms with 50 ha and over
EU	NAH	65.4	7
	UAA	6.1	68
Romania	NAH	91.8	0.5
	UAA	28.7	51.1
Poland	NAH	54.3	2.4
	UAA	13.2	31.6
Italy	NAH	58.7	4.5
	UAA	11.4	44.0
Spain	NAH	51.6	10.8
	UAA	4.3	70.8
France	NAH	24.3	41.3
	UAA	0.8	86.9
Germany	NAH	8.7	30.5
	UAA	0.3	78.3
United Kingdom	NAH	10.2	38.6
	UAA	0.3	88.2

Source: [17].

The larger farms with 50 ha and over in Romania represented 8.1% of the EU NAH belonging to this UAA size class.

The larger Romanian farms with 100 ha and over, accounting for 16.010 farms represented only 4.9% in the EU farms of this size class (Table 5).

In the yaer 2020, at the EU level, the farms smaller than 2 ha represented 42.55%, while the farms with 50 ha and more accounted for 7.50%.

In Italy, the highest share is also kept by the smaller farms than 2 ha (39.7%) and the farns with 50 ha and over represented 4.57%.

In Spain, 29.59% were smaller farns than 2 ha, while 11.65% were farms with 50 ha and more. In France, 10.86 % are smaller farms than 2 ha and 45.99% are larger farms than 50 ha. In Germany, the larger farms than 2 ha accounted for 31.57%, while the smaller farms than 2 ha were representde by 5.13%.

In Poland, the highest share is kept by the farns whose size varies between 2 and 4.9 ha (33.35%), the smaller farms than 2 ha accounts for 18.93% abd the lagest farms than 50 ha for 3.13% (Table 6).

Table 5. Romania's number of agricultural holdings by UAA size class, compared to the EU number of farms in the year 2020

UAA size class (ha)	**EU**		**Romania**		Share of the Romanian farms in the EU NAH by UAA size class (%)
	Number of agricultural holdings	Share in EU total NAH (%)	Number of agricultural holdings	Share in Romania's total NAH (%)	
	9,070,970	100.00	**2,887,070**	100.00	-
Zero	126,500	1.39	45,570	1.57	36.00
Less than 2	3,733,840	41.16	2,042,630	70.76	54.70
2 to 4.9	1,925,860	21.23	519,440	17.99	26.97
5-9.9	1,121,810	12.36	161,020	5.58	14.35
10-19.9	789,450	8.70	56,200	1.96	7.11
20-29.9	341,920	3.76	18,160	0.63	5.3
30-49.9	353,860	3.90	16,890	0.58	4.7
50.99.9	350,110	3.85	11,150	0.38	3.2
100 and over	327,620	3.65	16,010	0.55	4.9

Source: Own calculations based on the data from [17].

Table 6. Farm structure by UAA size class in Romania compared to the EU selected countries in 2020 (%)

Farms size class UAA (ha)	**EU**	**Romania**	**Poland**	**Italy**	**Spain**	**France**	**Germany**
Total farms	9,070,970	2,887,070	1,302,330	1,133,020	914,870	393,030	262,780
Share of farms by UAA size class							
Zero	1.39	1.57	0.32	1.10	0.87	1.14	1.49
Less than 2	41.16	70.76	18.61	38.60	28.72	9.72	3.64
2 to 4.9	21.23	17.99	33.35	24.33	21.95	8.77	3.04
5-9.9	12.36	5.58	21.69	14.13	14.41	8.72	17.03
10-19.9	8.70	1.96	14.79	9.66	11.32	9.41	20.00
20-29.9	3.76	0.63	4.71	3.98	5.51	6.14	9.53
30-49.9	3.90	0.58	3.40	3.63	5.57	10.11	13.70
50.99.9	3.85	0.38	2.02	2.86	5.52	19.81	17.02
100 and over	3.65	0.55	1.11	1.71	6.13	26.18	14.55

Source: Own calculations based on the data from [17].

At the EU level, of the total NAH, the smallest farms below 5 ha represent: 90.3% in Romania, 64.1% in Italy, 52.3% in Poland, 51.6% in Spain, 19.6% in France and 8.2% in Germany.

The farms with 50 ha and over accounted for 7.5% at the EU level, 1% in Romania, 3.1% in Poland, 4.5% in Italy, 11.6% in Spain, 31.5% in Germany and 45.9% in France.

The largest farms with 100 ha and more accounted for 3.6% at the EU level and for: 26.1% in France, 14.5% in Germany, 6.1% in Spain, 1.6% in Italy, 1.1% in Poland and 0.6% in Romania. The concentration degree of the farms by UAA size class in terms of the calculated values of Herfindahl-Hirschman Index and Gini-Struck Coefficient could be interpreted as follows:

- At the EU level and also in Poland and Italy, it is a relatively moderate concentration of the farms;
-In Romania it is high concentration of farms, as confirmed by the dominance of the ones with less than 2 ha;
-In Spain it is a moderate concentration, as the farms are relatively uniformly distributed by UAA size class;
-In France and Germany, it is a lack of concentration as the farms are the farms are almost equally distributed by UAA size class (Table 7).

Table 7. The degree of concentration of the farms by UAA size class in terms of HHI and GSC in Romania and the other EU selected countries in the year 2020

	EU	Romania	Poland	Italy	Spain	France	Germany
HHI	0.2432	0.5648	0.2187	0.2416	0.1771	0.1555	0.1495
GSC	0.3844	0.6984	0.3479	0.3831	0.2724	0.2234	0.2078

Source: Own calculations.

Table 8. Share of farms in NAH and UAA in each EU selected country by UAA size class in 2020 (%)

UAA size class (ha)		EU	Romania	Poland	Italy	France	Germany	Spain
0-4.9	%Farms	63.8	90.3	52.3	64.1	19.6	8.2	51.6
	%UAA	5.8	22.8	11.7	10.3	0.5	0.22	3.8
5-9.9	%Farms	12.4	5.6	21.7	14.1	9.7	17.0	14.4
	%UAA	5.8	8.5	13.6	8.9	0.9	1.95	3.9
10.19.9	%Farms	8.7	1.9	14.8	9.7	9.4	20.0	11.3
	%UAA	7.0	6.0	18.0	12.1	1.9	4.71	6.1
20-29.9	%Farms	3.8	0.6	4.7	4.0	6.1	9.5	5.5
	%UAA	5.3	3.5	10.0	8.7	2.2	3.75	5.2
30-49.9	%Farms	3.9	0.6	3.4	3.6	10.1	13.7	5.6
	%UAA	8.7	5.2	11.4	12.5	5.8	8.51	8.2
50-99.9	%Farms	1.9	0.4	2.0	2.9	19.8	17.0	5.5
	%UAA	15.7	6.1	12.1	17.8	20.9	19.11	14.9
100 and over	%Farms	3.6	0.6	1.1	1.6	26.1	14.5	6.1
	%UAA	52.5	47.8	23.2	29.7	67.8	61.75	57.8
Farms with 50 and over	%Farms	5.5	0.9	3.1	4.5	46.0	31.5	11.6
	%UAA	68.2	54.0	35.3	47.4	88.7	80.86	72.7

Source: [17].

Table 8 presents the share of farms in NAH and UAA in each EU selected country by UAA size class.

Farm structure by standard output size class

Standard output (SO) in Romania registered a relatively slight increase by 14.94% in the period 2007-2020, from Euro 10,120 million to Euro 11,632 million. In the EU, the growth rate was +22.92% in the same interval when standard output went op from Euro 285,587 in 2007 to Euro 351,079 in the year 2020.

As a result, Romania's contribution to the EU standard output declined a little from 3.54% in 2007 to 3.31% in 2020 (Table 9).

Compared to the other selected EU countries, Romania's contribution to the EU's standard output is very small (Table 10).

Table 9. Dynamics of Standard output in Romania compared to the trend in the EU, 2007-2020 (Euro million)

	2007	2010	2013	2020	2020/2007 %
EU	285,597	308,062	331,568	351,079	122.92
Romania	10,120	10,420	11,990	11,632	114.94
Share of Romania in the EU (%)	3.54	3.38	3.62	3.31	-

Source: Own calculations based on the data from [9, 10, 11, 12, 14, 15, 17].

Table 10. Share of the NAH and SO of Romania into the EU NAH and SO compared to the other selected countries in the year 2020 (%)

	Share in the EU's NAH (%)	Share in the EU's SO (%)
Romania	31.8	3.31
Poland	14.4	7.3
Italy	12.5	18.6
Spain	10.1	11.5
France	4.3	17.7
Germany	2.9	12.5

Source: [17].

Distribution of agricultural holdings by standard output size class

In the EU, the dispersion of farms by standard output size classes varies from a country to another.

At the EU level, the highest share accounting for 35.71% belongs to the farms producing less than Euro 2,000, being followed by 14.19% farms which carry out between Euro 2,000 and 3,999 and then by 12.94% farms achieving between Euro 4,000-7,999.

Only 1.96% farms are able to produce between Euro 250,000-499,999 and 1.33% farms between Euro 500,000 and over.

Romania is an important contributor to the EU agricultural output, and also to EU standard output and GDP coming from agriculture [29, 32].

However, in Romania 71.5% of the farms produced less than Euro 2,000, being followed by 13.74% farms carrying out Euro 2,000-3,999. Then, 7.48% farms produced between Euro 4,000-7,999. Just 0.09% farms are able to produce between Euro 250,000-499,999 and 0.07% farms achieve Euro 500,000 and more.

In terms of Standard Output, reflecting the farm economic size, the Romanian holdings achieve much less compared to the EU average and the other EU member states, aspect which reflects the consequence of the dominance of the semi-subsistence farms lacked of competitiveness and efficiency existing in Romania [1].

In France, 25.71% farms produce Euro 100,000-249,999, 13.52% farms achieve Euro 250,000-499,000 and 6.17% farms carry out Euro 500,000 and over. Only 5.5% farms produce less than Euro 2,000.

In Germany, just 0.54% farms produce below Euro 2,000, and the highest share of 17.58% belongs to the farms achieving Euro 100,000-249,999. About 7.67% farms produce the highest standard output, Euro 500,000 and more.

In Italy, the highest weight of 17.57% belongs to the farms able to carry out Euro 8,000-14,999, also 16.27% farms produce Euro 4,000-7,999 and 13.35% farms achieve between Euro 25,000-49,999. Only 1.54% farms produce Euro 500,000 and over.

In Spain, 17.16% farms produce less than Euro 2,000, but 16.64% farms produce Euro 4,00-7,999, 14.73% achieve between Euro 2,000- 3,999 and 13.91% carry out between Euro 8,000-14,999. Only 3.43% farms are able to produce Euro 250,000 and more standard output.

In Poland, The highest share of 26% farms produce less than Euro 2,000, being followed by 19.65% farms producing Euro 2,000-3,999, then other 12.32% farms carry out Euro 8,000-14,999. Only 0.92% farms produce Euro 250,000 and more SO (Table 11).

The concentration degree of the farms by standard output size class in terms of the values of Herfindahl-Hirschman Index and Gini-Struck Coefficient reflects the situation presented below (Table 12).

- At the EU level, the farm concentration is relatively moderate;

-In Romania, it is a high concentration of the farms, as proved by the dominance of the farms producing less than Euro 2,000;

-In Poland and Italy, it is a moderate concentration;

-In Spain, France and Germany, it is a lack of concentration, as the farms are uniformly distributed by standard output size class (Table 12).

Table 11. The dispersion of farms in Romania and the selected EU countries by standard output size class in the year 2020 (%)

SO size class (Euro)	EU	Romania	Poland	Italy	Spain	France	Germany
Total number of farms	9,070,970	2,887,070	1,302,340	1,133,020	914,870	393,030	262,780
Zero	0.83	0.85	0.66	1.44	0.59	0.17	0.04
Less than 2,000	35.71	71.50	26.00	8.46	17.16	5.50	0.54
2,000-3,999	14.19	13.74	19.65	10.56	14.73	3.40	4.67
4,000-7,999	12.84	7.48	17.59	16.27	16.64	5.14	10.55
8,000-14,9999	9.92	3.14	12.32	17.57	13.91	6.94	12.73
15,000-24,999	6.52	1.36	7.82	12.56	9.29	6.74	10.00
25,000-49,999	6.95	1.03	7.90	13.36	10.14	11.36	12.44
50,000-99,999	5.12	0.45	4.81	9.26	8.09	15.35	12.52
100,000-249,999	4.53	0.28	2.33	6.85	6.02	25.71	17.58
250,000-499,999	1.96	0.09	0.58	2.13	1.93	13.52	11.26
500,000 and over	1.33	0.07	0.34	1.54	1.50	6.17	7.67

Source: Own calculation based on the data from [17].

Table 12. The degree of concentration of the farms by SO size class in terms of Herfindahl-Hirschman Index and Gini-Struck Coefficient in Romania and the other EU selected countries in the year 2020

	EU	Romania	Poland	Italy	Spain	France	Germany
HHI	0.2266	0.5370	0.1676	0.1520	0.1278	0.1408	0.1202
GSC	0.3863	0.7004	0.2904	0.2592	0.2014	0.2342	0.1794

Source: Own calculations.

Distribution of Standard output by SO size class

-*At the EU level*, the superior SO size classes produce the most SO, as we may notice that, starting from the SO size class Euro 50,000 and over, it is produced 83.92% of the EU SO.

-*In Romania*, 45% of SO is achieved by the SO size class Euro 50,000 and over and 32.06% SO is carried out by the SO size class below Euro 8,000.

-*In France*, 95.79% SO is produced by the SO size classes Euro 50,000 and more;

-*In Italy*, 81.97% SO is carried out by the SO size classes Euro 50,000 and more;

-*In Germany*, 94.87% SO is produced by the superior classes of Euro 50,000 and over;

- *In Spain*, 80.74% SO is achieved by the high SO size classes with Euro 50,000 and over.

-*In Poland*, 61.86% SO is carried out by the high SO size classes with Euro 50,000 and over (Table 13).

Table 13. Dispersion of Standard output in Romania and in the EU selected countries by SO size class in the year 2020 (%)

SO size class (Euro)	**EU**	**Romania**	**Poland**	**Italy**	**Spain**	**France**	**Germany**
Total standard output (Euro Million)	351,079	11,632	25,631	65,353	40,368	62,268	44,368
Share by SO size class (%)							
Less than 2,000	0.77	12.50	1.54	0.16	0.41	0.03	0.004
2,000-3,999	1.05	9.44	2.88	0.53	0.97	0.06	0.088
4,000-7,999	1.90	10.12	5.08	1.64	2.17	0.19	0.375
8,000-14,9999	2.80	8.20	6.85	3.35	3.47	0.49	0.848
15,000-24,999	3.24	6.24	7.67	4.20	4.08	0.83	1.156
25,000-49,999	6.32	0.51	14.12	8.15	8.16	2.60	2.646
50,000-99,999	9.29	7.56	16.82	11.25	12.88	7.08	5.368
100,000-249,999	18.18	9.80	17.25	18.09	20.28	26.33	16.902
250,000-499,999	17.13	7.47	9.27	12.63	13.72	29.03	22.840
500,000 and over	39.32	20.15	18.52	40.00	33.86	33.36	49.776

Source: Own calculation based on the data from [17].

Regarding the degree of concentration of standard output by SO size class in Romania and the EU selected countries in the year 2020, it was found the following situation:

-*At the EU level*, it is a moderate concentration of the standard output;

- *In Romania and Poland*, it is a lack of concentration, as SO is relatively uniformly distributed by SO size class;

- *In Italy and Spain*, it is a moderate concentration of SO by SO size class;

-*In France,* it is a relatively moderate concentration of SO among SO size classes;

- *In Germany*, it is a high concentration of SO, as reflected by the high share in SO of the superiors SO size class Euro 500,000 and over (Table 14).

Table 14. Degree of concentration of SO by SO size class in terms of Herfindahl-Hirschman Index and Gini-Struck Coefficient in Romania and the EU selected countries in the year 2020

	EU	Romania	Poland	Italy	Spain	France	Germany
HHI	0.2319	0.1141	0.1348	0.2311	0.2012	0.2711	0.3323
GSC	0.3828	0.1251	0.1966	0.3816	0.3352	0.4360	0.5080

Source: Own calculations.

Standard output per agricultural holding

In the EU, the value of SO/AH increased from Euro 20.9 thousand in the year 2007 to Euro 38.7 thousand in the year 2020, meaning by +85.16%, *In Romania*, it also increased, but from Euro 2.42 thousand in 2007 to Euro 4.03 in 2020, that is by +66.52%. In consequence, the share of SO per agricultural holding produced in Romania in the EU SO/AH decreased from 11.5% in 2007 to 10.4% in 2020, that is by -1.1 percentage points (Table 15).

Table 15. Dynamics of Standard output per agricultural holding in Romania compared to the EU, 2007-2020 (Euro 1,000/holding)

	2007	2010	2013	2020	2020/2007 %
EU	20.9	25.6	30.65	38.8	185.16
Romania	2.42	2.80	3.30	4.03	166.52
Share of Romania in the EU (%)	11.5	10.9	10.76	10.4	-

Source: Own calculations based on the data from [9, 10, 11, 12, 14, 15, 17].

Average standard output per agricultural holding by SO size class in Romania and the EU selected countries in the year 2020 (Euro/AH)

In the year 2020, the average SO/AH accounted for Euro 38,703/farm.

In Romania, it was very small, accounting for Euro 4,029/farm that is it was 9.6 times smaller than the EU average.

In Poland, it was achieved Euro 19,680 SO/AH, being 1.98 times smaller than the EU average.

In Italy, it was carried out Euro 57,681 SO/AH, meaning 1.5 times higher than the EU average SO/AH.

In Spain, it was produced Euro 44,124 SO/AH, a level which is 1.14 times higher than the EU average.

In France, it was obtained Euro 158,430 SO/AH, being 4.09 times higher than the EU average.

In Germany, it was registered the highest SO/AH accounting for Euro 167,631/AH, being 4.33 times higher than the EU average (Table 16).

In all the studied countries it was normally as SO/AH to increase from the SO size class less than Euro 2,000 to the superior SO size class Euro 500,000 and over.

But, if we compare the average SO/AH in each country with the EU average SO/AH, we may easily notice large deviations as follows:

- *In case of Romania*, the average SO/AH for almost all the SO size classes does not exceed the EU average SO/AH, except the superior SO size class with Euro 250,000 and over SO.

Also, we have to specify, that the average SO/AH produced by the superior SO size

class Euro 500,000 and over in Romania, accounting for Euro 1,263,878 is by +16.22% higher than in Germany.
Also, this figure is by + 26.22% higher than in Spain, by +47.49 higher than in France and by +61.42% higher than in Poland.
But, is also by - 15.72% lower than the one achieved by Italy.
-*In France*, the EU average SO/AH is exceeded by the SO size classes ranging between Euro 2,000 and Euro 499,999.
A smaller average SO/AH was recorded in case of the SO size class less than Euro 2,000, and also in case of the SO size class Euro 500,000 and over.
-*In Germany*, almost all the SO size classes exceeds the EU average SO/AH, except the SO size class Euro 500,000 and over.
-*In Italy*, the EU average SO/AH is exceeded only by the SO size classes ranging between less Euro 2,000 and Euro 24,999, and also between Euro 250,000 and over.
Therefore, the SO size classes between Euro 25,000 and 249,999 registered a smaller SO/AH than the EU average.
-*In Spain*, The EU average SO/AH is exceeded only in case of the SO size classes varying between Euro 2,000 and Euro 49,999.
Therefore, the SO size classes ranging between Euro 50,000 and over recorded a smaller average SO/AH than the EU average.
-*In Poland*, we noticed a similar situation like in Spain, that is, the SO in smaller size classes had an average SO/AH higher than the EU average.
The superior SO size classes with Euro 50,000 and over achieved a smaller average SO/AH than the EU average (Table 16).
Table 16 presents average Standard output per agricultural holding by SO size classes in Romania and the EU selected countries in the year 2020 (Euro/AH).

Table 16. Average Standard output per agricultural holding by SO size classes in Romania and the EU selected countries in the year 2020 (Euro/AH)

SO size class (Euro)	EU	Romania	Poland	Italy	Spain	France	Germany
Average SO/AH	38,703	4,029	19,680	57,681	44,124	158,430	167,631
Average SO/AH by SO size class (Euro/AH)							
Less than 2,000	833	707	1,169	1,087	1,048	799	1,454
2,000-3,999	2,854	2,786	2,886	2,905	2,914	2,921	3,082
4,000-7,999	5,669	5,482	5,679	5,815	5,760	5,818	5,921
8,000-14,9999	10,926	10,650	10,948	11,024	11,012	11,280	11,139
15,000-24,999	19,252	18,949	19,289	19,306	19,351	19,532	19,378
25,000-49,999	35,187	34,040	35,388	35,180	35,481	36,287	35,584
50,000-99,999	70,239	68,629	68,826	70,092	70,224	72,062	71,882
100,000-249,999	155,403	152,464	145,350	152,246	148,697	162,265	161,134
250,000-499,999	336,987	341,016	320,335	342,017	313,278	340,125	340,118
500,000 and over	1,141,919	1,253,978	108,830	1,499,593	1,001,360	856,873	1,087,571

Source: Own calculation based on the data from [17].

CONCLUSIONS

In 2020, Romania had 12,763 thousand ha UAA, by -13.3% smaller than in 2003 and representing 7.67% of the EU's UAA.
The values of HHI and GSC smaller than 15% reflects that there are no significant differences regarding UAA from a region to another.
Taking into account its UAA, Romania is ranked the 6th after France, Spain, Germany, United Kingdom, and Poland, being followed by Italy till 2019, and after Brexit, in 2020, it preserved its 6th position, but after France, Spain, Germany, Poland and Italy.
In 2020, Romania had 2.88 million farms, by about 60% less than in 2003. The share of its farms in the EU's NAH was 7.67%.
In 2020, Romania, Poland, Italy, Spain, France and Germany, all together had 6.89 million agricultural holdings, meaning 75.75% of the EU's NAH. In the interval 2005-2020, the EU lost 36.7% farms.
The average farm size is one of the smallest in the EU, that is 4.42 ha/AH being 3.93 times smaller than the EU's average accounting for

17.4 ha/farm and also compared to the other EU countries selected in this study.

At the EU level, the farms with less than 2 ha account for 70.7% in Romania, 42.55%, in Spain for 29.5%, in Poland for 18.9%, in Italy for 11.6%, in France for 10.8%, in Germany for 5.1%.

Of the total EU's NAH, the smallest farms below 5 ha represent: 90.3% in Romania, 64.1% in Italy, 52.3% in Poland, 51.6% in Spain, 19.6% in France and 8.2% in Germany.

The farms with 50 ha and over accounted for 7.5% at the EU level, 1% in Romania, 3.1% in Poland, 4.5% in Italy, 11.6% in Spain, 31.5% in Germany and 45.9% in France.

The values of HHI and GSC for the average UAA/farm the following concentration type: high concentration in Romania, relatively moderate Poland, Italy and Spain, and lacked of concentration in Germany.

In 2020, Romania produced Euro 11,632 million standard output, accounting for 3.3% of the EU's SO. The other EU countries contribute by much more: Poland 7.3%, Spain 11.5%, Germany 12.5%, France 17.7% and Italy 18.6%.

In the EU, the dispersion of farms by standard output size classes varies from a country to another.

In 2020, the farms producing less than Euro 2,000 per farm and year represent: 35.7% at the EU level, 71.5% in Romania, 26% in Poland, 17.1% in Spain, 8.4% in Italy, 5.5% in France and 0.54% in Germany.

The farms producing Euro 250,000 and over accounted for: 3.29% at the EU level, 0.16% in Romania, 0.92% in Poland, 3.43% in Spain, 3.67% in Italy, 18.93% in Germany and 19.69% in France.

The farms producing Euro 50,000 and over represented for: 12.9% at the EU level, 0.9% in Romania, 8.1% in Poland, 17.5% in Spain, 19.8% in Italy, 49% in Germany and 60.7% in France.

The values of HHI and GSC reflected the following degree of concentration of the farms by SO size class: high concentration in Romania, relatively moderate at the EU level, moderate in Poland and Italy, lack of concentration in Spain, France and Germany.

The SO size class Euro 50,000 and over contribute by 83.92% to the EU's SO, in Romania by 45%, in France by 95.7%, in Germany by 94.8%, in Italy by 81.9%, In Spain by 80.7% and in Poland by 61.8%.

The values of HHI and GSC reflected the following degree of concentration of SO by SO size class: High concentration in Germany, relatively moderate in France, moderate concentration at the EU level, Italy and Spain, lack of concentration in Romania and Poland.

In 2020, the standard output per holding accounted for: Euro 38,703 at the EU level, Euro 4,029 in Romania, Euro 19,680 in Poland, Euro 57,681 in Italy, Euro 44,124 in Spain, Euro 158,430 in France and Euro 167,631 in Germany.

As a final conclusion, while the UAA and NAH declined, the average UAA/farm and SO/farm increased at the EU level, in Romania and in all the selected EU countries analyzed in this study.

However, Romania has still the highest number of farms compared to the other EU countries, but its average farms size is very small 4.43 ha/farm and in terms of SO/farm as well, recording just Euro 4,029/farm and year.

Poland has a better situation from all these points of view, but a middle one compared to the performance recorded by the other EU member states.

France and Germany are definitely on the top positions regarding average farm size in ha/farm and mainly SO/farm.

These discrepancies among these countries are caused by the unbalanced farm structure with the highest share belonging to the farms with less than 2 ha.

Farms with 50 ha and over could be considered of a corresponding size which could also assure a higher SO/farm.

The decline in the number of farms has to continue stimulating the growth of farm size and economic power of the farms.

For Romania, it is still a long-term process to diminish the number of agricultural holdings, and assure a higher economic efficiency in terms of standard output.

Small and medium-sized farms have to be encouraged and supported to merge their

efforts for a higher concentration of land, production and economic efficiency.

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