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ORGANISATIONAL CHANGES IN POLISH AGRICULTURE IN THE LAST 10 YEARS ON THE BACKGROUND OF THE EU AGRICULTURE*

Abstract

Transformation to a market economy in 1990 year and accession to the European Union in 2004 year had a big impact on the functioning of our agricultural sector and the organisation of farms in Poland.

The aim of the paper is try to determine the organisation changes and process of production concentration in Polish agriculture on the background of selected countries in EU. The results indicate that the concentration and specialisation of production is necessary for economic and organisational reasons. This underpins the increase in productivity, improvement of the economic condition and easier sale of agricultural products. Unfortunately, these processes are also associated with an increase in pressure from agriculture on the natural environment.

Keywords: organisational changes, EU, accession, Polish agriculture, economic size, system transformation.

Introduction

The transformation into a market economy in 1990 and accession to the European Union in 2004 had a big impact on the functioning of the agricultural sector and the organisation of farms in Poland. The deterioration of income situation in

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agriculture in the first years after the system transformation resulted in numerous farms being unable to restore the production potential. After the integration with the EU the farms were unable to use the available funds for restructuring and modernisation, and direct payments alone increased their income only partly and did not prevent the liquidation of the weaker ones (Chechelski P. et al. 2012; Józwiak W. et al. 2011). More effective farms began to search for possibilities to develop through concentration of production and specialisation. Modern, expensive technological equipment is a determinant of an increase in labour productivity, but its wider use requires systematic expansion of the scale of production through land concentration and an increase in the size of herds kept, i.e. specialisation of production. As a result, the number of plants cultivated on a farm is limited to 2-3 species (technologically similar plants) and sporadically some species are periodically cultivated in monocultures. In animal production, farm breeding of large herds of the same species, often fed with purchased fodder, is becoming increasingly common.

Simplifications in the organisation of plant production are offset with a greater usage of industrial means of production, including primarily chemical plant protection products and mineral fertilisers. Such organisation of production may exacerbate the negative impact of agriculture on the environment (Kuś. J. 2012, 2013). Farms specialising in animal production usually have stocks of natural fertilisers that are too large to be rationally used, which increases the risk of polluting underground and surface waters with nitrogen and phosphorus compounds. Farms that do not keep animals do not have such fertilisers at all, which makes it difficult to maintain sustainable balance of soil organic matter and is particularly dangerous on light soils (Kuś J., Kopiński J. 2012). The simplification of crop rotation and reduction of the variety of cultivated plants also reduce the biodiversity of flora and fauna on utilised agricultural area (Kuś J. 2013).

The aim of the paper is to define organisational changes and production processes in the Polish agriculture on the background of selected EU countries. It builds on the available data of the Polish Central Statistical Office (GUS) and Eurostat.

Reasons for changes in organisation of agricultural holdings in Poland

The growth rate of agricultural product prices is not proportionate to the growth rate of prices of the means of production purchased by farmers and the costs of labour (Fig. 1). Within 18 years (1995-2012), the prices of products sold by farmers increased by approximately 230% in total while the prices of the means of production purchased by farmers grew by around 320%. The prices of agricultural products grew faster in 2010-2012, but the growth was largely compensated with higher prices of the means of production within that period and did not translate into improvement of farms' income. In addition, the average level of wages in the national economy increased 5-fold within the same period.

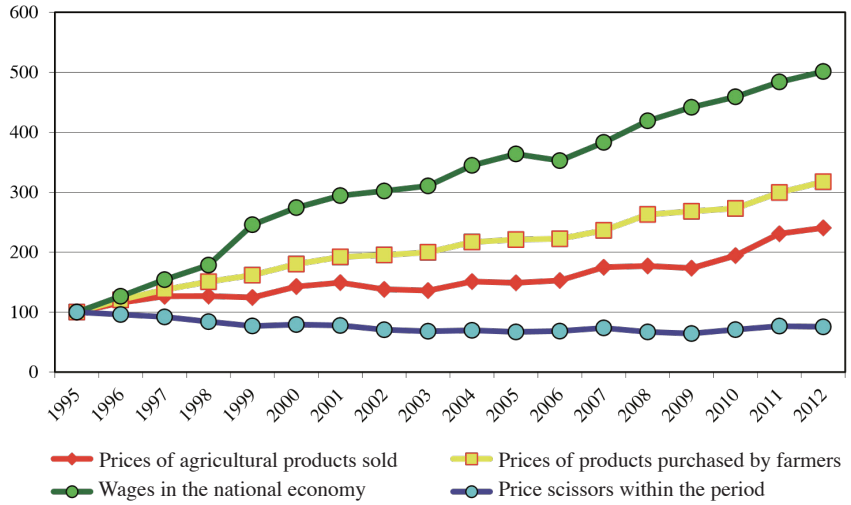

Fig. 1. Changes (%) in the prices of the means of production and agricultural products in 1995-2012.

Source: (Runowski H. 2014).

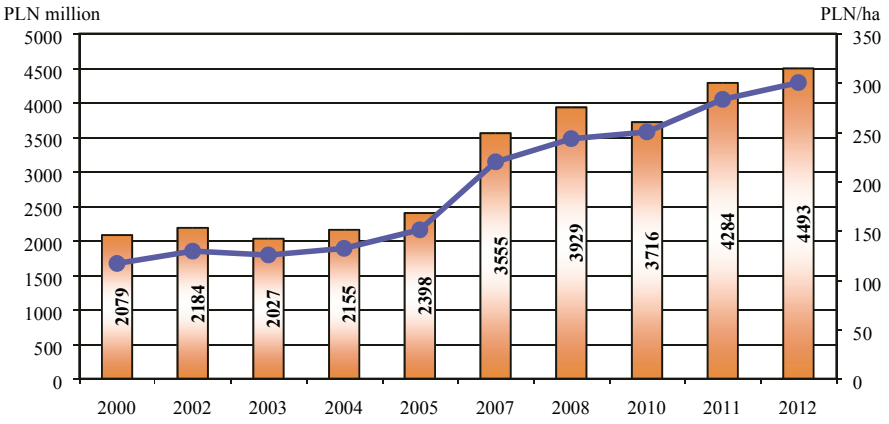

Fig. 2. Investment expenditure in Polish agriculture in total (PLN million) and per 1 ha of utilised agricultural area (PLN/ha) in 2000-2012.

Source: (Runowski H. 2014).

Therefore, agricultural holdings are forced to undergo organisational transformations in order to boost labour productivity and cut down the production costs. Labour productivity in agriculture is increased mainly by means of specialisation and increased scale of production. In Western European countries, the concentration of production and specialisation of farms progressed at a fast rate within

the last decades of the 20th century, while in Poland the process began with the transformation into a market economy, and accelerated after the accession to the EU. Integration with the EU resulted in a significant increase in the amount of funds allocated for investments on farms (Fig. 2). In 2000-2005, total investment expenditure amounted to PLN 2.1-2.3 billion annually, which translates into around PLN 150 per 1 ha of utilised agricultural area, while in 2007-2012, thanks to the EU funds, it increased 2-fold. The principal amount of investment funds was allocated for purchase of tractors and other agricultural equipment, but also for modernisation of farm buildings, fruit storage facilities, etc.

Number and size of farms

In 2000-2012, the total number of agricultural holdings in Poland decreased by 535,800, i.e. by 26.4% (Rocznik Statystyczny Rolnictwa 2001, 2013). The period also saw significant changes in the area structure of farms (Fig. 3). The number of small and very small holdings (1-10 ha) decreased by 526,000 in total, i.e. by over 30%, while the number of larger farms grew by 25,800 (34%) in the group of 20-50 ha holdings and by 15,700 (216%) in the group of farms with an area over 50 ha of utilised agricultural area. The above changes resulted in an increase in an average utilised agricultural area per farm from 7.2 ha in 2000 to 9.6 ha in 2012 (Rocznik Statystyczny Rolnictwa2013).

However, despite the changes, the area structure of Polish farms remains very unfavourable compared to the EU countries (Table 1). In Poland, farms with an area exceeding 20 ha used only approx. 50% of utilised agricultural area in 2010. In neighbouring countries with a similar agricultural production profile, these groups of farms had from 73% of total utilised agricultural area in Austria to 98% in Denmark. In Southern European countries with a different structure of agricultural production, the share of small farms is higher, but the share of large holdings is significant too. In Italy, the farms with an area exceeding 20 ha of UAA accounted for over 62% of total utilised agricultural area in 2010. Romania has a very specific area structure of farms – almost 30% of utilized agricultural area belongs to very small farms (up to 5 ha) and over 50% to large farms (over 50 ha), while the share of medium-sized holdings is insignificant. As a result, the average size of a farm in Romania is only 3.7 ha, while the average for Poland is 9.6 ha and for the EU – 15 ha.

The increase in the area of farms and the decrease in their number are observed in all the EU countries (Table 1). In 2003-2010, in the EU-27 the number of farms declined by 18% on average. The process was slower in the EU countries with a stable agriculture and much faster in the countries that had joined the EU in 2004. The low pace of the decrease in the number of farms in Romania shows that the country has just started implementing organisational changes in agriculture.

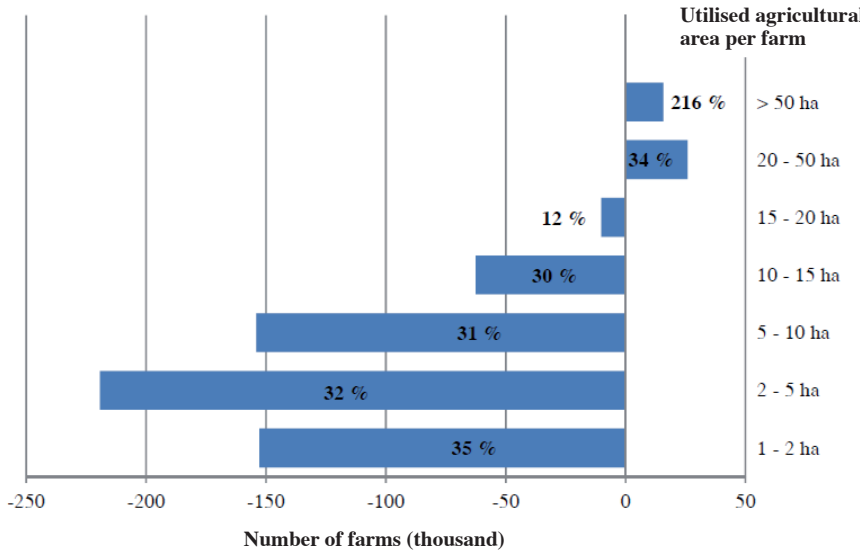

Fig. 3. Change in the number of agricultural holdings in Poland in 2000-2012 in various area groups.

Source: own calculation based on GUS data (Rocznik Statystyczny Rolnictwa 2001, 2013).

Table 1

Utilized agricultural area (%) on farms with various area, average size of an agricultural holding in the selected EU countries and the reduction in the number of farms in 2003-2010

Country	UAA (%) on farms with an area of (ha)					Farm area (ha of UAA)	Decrease in the number of farms (2003 = 100%)
	0-5	5-10	10-20	20-50	> 50		
Poland	13.9	16.5	20.8	19.2	29.5	9.6	31
Czech Republic	0.2	0.8	1.6	4.0	93.5	152.0	50
Slovakia	1.5	1.0	1.2	2.3	94.0	81.3	34
Austria	4.1	6.7	16.4	34.7	38.1	19.2	14
Denmark	0.2	2.2	4.2	11.2	87.2	65.8	8
France	1.0	1.2	2.6	10.8	84.5	57.2	16
Netherlands	2.4	4.0	8.4	34.4	50.8	26.1	15
Germany	0.3	2.1	5.7	15.2	76.8	56.0	27
Italy	14.4	10.1	12.9	20.9	41.7	8.1	17
Romania	29.7	9.1	4.3	4.1	52.8	3.7	12
EU-27	6.9	5.3	7.4	14.3	66.1	15.0	18

Source: own study based on: (Agriculture in the European Union 2013).

Table 2

Structure (%) of agricultural holdings in 2010 by economic size in Poland and in the selected EU countries (EUR thousand)

Country	Economic size									Total – thousand of farms (100%)
	Up to 2	2-4	4-8	8-15	15-25	25-50	50-100	100-250	> 250	
Poland	29.4	19.3	18.2	12.9	7.5	6.3	2.4	0.9	0.4	1506.6
Czech Republic	5.9	10.8	18.0	15.2	10.5	12.2	8.9	7.3	10.6	22.9
Slovakia	30.9	27.4	16.1	7.0	3.6	3.5	2.7	2.7	4.8	24.5
Austria	13.9	9.1	13.5	13.7	11.3	16.0	12.8	7.7	1.8	150.2
Denmark	1.9	2.7	9.0	13.8	12.5	14.9	11.1	10.7	20.5	42.1
France	8.1	6.3	8.1	8.2	7.4	12.9	17.5	22.1	9.0	516.1
Netherlands	0.1	2.6	9.2	9.0	6.8	8.8	9.6	23.3	30.4	72.3
Germany	0.4	2.2	8.8	12.4	10.3	14.1	16.5	21.5	13.6	299.1
Italy	30.4	16.3	14.6	10.9	7.4	7.9	5.5	3.7	1.8	1620.9
Romania	70.5	15.6	8.1	2.0	0.6	0.3	0.2	0.1	0	3859.0
EU-27	43.2	15.7	12.3	7.9	4.9	5.1	3.8	3.3	1.8	11,971.7
EU-15	22.6	14.7	14.4	11.6	7.9	9.1	7.6	7.1	3.9	5182.5
EU-12	58.4	16.8	10.8	5.1	2.6	2.1	0.9	0.4	0.2	6789.2

Source: own study based on: (Agriculture in the European Union 2013).

Economic size, which determines the possibility to generate income, is a better characteristic of agricultural holdings than the utilised agricultural area. According to the EU typology, as many as two thirds of Polish agricultural farms are very small farms, i.e. their economic size does not exceed EUR 8000 (Table 2) (Agriculture in the EU... 2013; Poczta W. 2012). Small farms (EUR 8000-25,000) account for another 20% and large and very large holdings (over EUR 100,000) for only 1.3% of farms. In the EU-27 on average, the share of very small holdings is even slightly higher than in Poland, but the percentage of small and medium-sized farms is lower, and the share of large and very large holdings even higher (5.1%). In the new EU countries (EU-12), very small farms account for 86%. It is mainly due to the structure of agriculture in Romania, where 94% of agricultural holdings are small farms.

In Poland, it is assumed that farms with economic size lower than 8 ESU (EUR 9600) are unable to restore production capacity and to take over the land of their neighbours who abandon farming (Józwiak W. 2011).

Concentration of animal production

Concentration and specialisation in animal production progress at a much faster rate than in plant production. In Poland, within the last 17 years the

number of farms keeping cows has been declining gradually – from 1,259,000 in 1996 to 380,000 in 2012 (Table 3). In 1996, cows were kept on 62% of Polish farms, while in 2012 the percentage dropped to 26%.

Table 3

Farms keeping cows (thousand) in 1996-2012 by herd size

Size of cow herd (LSU)	1996	2002	2007	2010	2012	
					thousand	1996 = 100%
1-2	861	560	441	273	211	24.5
3-4	249	131	76	53	44	17.7
5-9	127	94	63	50	45	35.4
10-19	19	45	52	48	48	252.6
20-49	1.5	10	22	27	29	1 933
>50	1.8	1.3	1.3	3.4	3.5	194.4
Number of farms keeping cows (thousand)	***1259***	***841***	***656***	***454***	***380***	***30.2***
Cow stock (LU thousand)	***3579***	***2879***	***2854***	***2657***	***2578***	***72.0***
Average number of cows on a farm	***2.84***	***3.42***	***4.35***	***5.85***	***6.78***	***238.7***

Source: own study based on GUS data (*Systematyka*... 2003; *Charakterystyka gospodarstw*... 2012; *Użytkowanie gruntów*... 2012).

The number of farms with 1 to 4 cows decreased particularly strongly – almost 5-fold. At the same time, the number of holdings with larger herds of cows was increasing. The surge in the number of farms with cow herds consisting of 20 to 50 animals is particularly impressive. In the first decade of the 21st century, it was estimated that a holding with such scale of cow breeding can be effective in economic terms and the farmer's income may be comparable to wages in other sections of the economy (parity income). The number of such farms in the analysed period grew from 1500 to 29,000, i.e. it increased 19-fold. The number of holdings keeping the herds with over 50 cows also increased almost twice.

The average number of cows on holdings conducting such production grew from 2.8 in 1996 to 6.8 in 2012. Specialisation and concentration of production were also conducive to an increase in productivity, since average milk yield from a cow grew from 3210 in 1996 to 4845 in 2012 (Runowski H. 2014).

Information presented in Figure 4 demonstrates even more strikingly the progressing concentration of cow and milk production. Between 2005 and 2014, the number of wholesale suppliers of milk fell from 311,000 to less than 138,000, i.e. by 56%. Within that period, the average amount of milk supplied by one holding increased from 27 to 73 tonnes a year. The dynamic growth of the amount of milk sold by one farm within the last 3 years may be explained by the fact that some producers were preparing for competition after liquidation of milk quotas scheduled for April 2015.

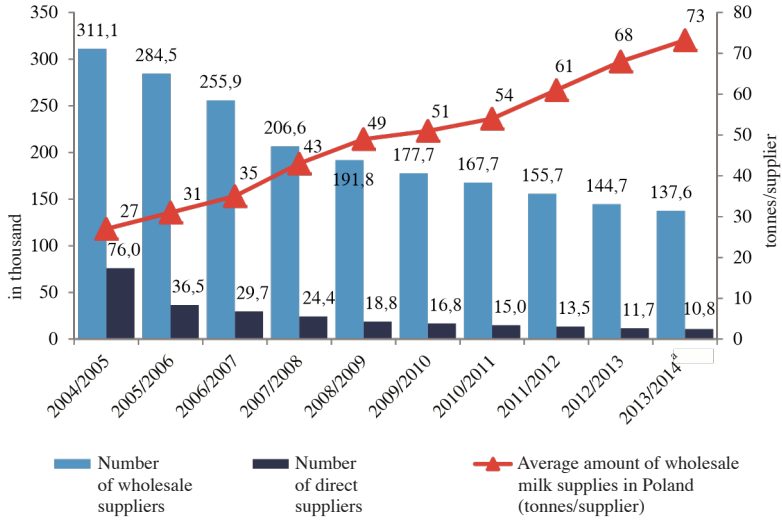

Fig. 4. Number (thousand) of wholesale and direct suppliers of milk in Poland at the end of each quota year and the amount of wholesale sales (tonnes/year).

Source: Agricultural Market Agency – unpublished data.

Table 4

Cows (%) in herds of various size and average number of cows on a farm in Poland and the selected EU countries in 2010

Country	Size of cow herd (LU)							Average number on a farm	Decrease (%) in the number of farms[a]
	1-2	3-9	10-19	20-29	30-49	50-99	> 100		
Poland	6.3	13.6	15.9	14.7	20.8	16.6	12.2	5.9	51.3
Czech Republic	0.1	0.3	0.4	0.5	1.2	2.3	95.2	122.9	63.3
Slovakia	2.7	2.1	0.6	0.4	0.3	1.1	92.8	24.5	55.7
Austria	0.1	3.2	10.7	15.2	28.5	32.2	10.2	11.3	26.7
Denmark	0	0	0	0.1	0.3	2.5	97.0	133.7	22.3
France	0	0.2	0.5	1.0	3.9	23.4	71.0	45.0	27.5
Netherlands	0	0	0.1	0.3	1.8	15.3	82.5	74.6	20.8
Germany	0	0.2	1.1	2.0	6.3	19.7	70.7	46.4	26.3
Italy	0.2	1.8	3.5	3.7	7.5	15.9	67.3	35.2	22.8
Romania	43.4	33.6	6.9	3.2	3.3	3.4	6.2	1.8	16.0
EU-27	3.5	4.3	3.7	3.8	7.4	16.8	60.6	13.7	33.3

[a] 2003 = 100%.

Source: own study based on: (Agriculture in the European Union 2013).

Changes in the group of direct suppliers of milk take place even faster. Their number fell 7-fold within the analysed 10 years, from 76,000 to less than 11,000 (Fig. 4).

Figures in Table 4 point to intensive and increasing concentration in dairy cow production in the EU. In 2010, in the EU-27 on average over 60% of cows were kept in herds of over 100 cows. In the majority of the analysed countries, such herds accounted for 70-95% of all cow stock, while for Poland the figure stood at 12%, it was low also in Austria (10%) and the lowest in Romania (6%). In the EU, Romania stands out due to the most fragmented structure of cow herds, since as many as 78% of all cows are kept in herds with up to 9 animals. In Poland, the figure is 20%, while in other EU countries such small herds are of no practical importance.

The average number of cows on a farm in the EU-27 in 2010 amounted to 13.7, in Poland to 5.9, in Romania to 1.8, while in other countries it ranged from 11 in Austria to 120-130 cows in the Czech Republic and Denmark.

Between 2003 and 2010, 33% of holdings abandoned dairy cow production on average in the EU (Table 4). In individual countries, the percentage ranges from 16% in Romania to 50%-60% in Poland, the Czech Republic and Slovakia. The number of holdings keeping small herds of cows (up to 9 animals) declined by approx. 40% on average in the EU, while the number of farms with over 100 cows grew by 30%.

The concentration of cow production is possible due to new technological solutions (mechanical lines to prepare and distribute fodder, milking machines, etc.). The machines significantly increase labour productivity, on the one hand, and force the growth of the scale of production in holdings due to the need to fully use the expensive machines, on the other.

It is more difficult to evaluate the process of concentration of pig production, since in 1996-2012 the number of pigs in Poland was reduced from 20.4 million to 11.6 million, i.e. by as much as 43.3% (Table 5). Within the same period the number of agricultural holdings conducting such production declined from 1,029,000 to 260,000, which means that 75% of farms abandoned pig production. The share of farms keeping pigs for fattening fell from 50% of total number of agricultural holdings in Poland in 1996 to 18% in 2012. The drastic fall in the number of pigs was recorded in 2010-2012 due to particularly unfavourable ratios of the prices of feed to the prices of pig livestock.

Within the analysed period, the number of farms keeping large herds of animals (over 200 animals) increased by 70% (from 4700 to 8000). The number of farms with small herds of pigs (less than 20 animals) declined markedly, 4-5-fold. It is impossible to assess the changes in pig production concentration more precisely based on the available statistics, since the identified group of farms keeping over 200 or 500 animals comprises also large farms keeping several thousand pigs.

Table 5

Pig farms (thousand) in 1996-2012 by herd size

Herd size (LU)	1996	2002	2007	2010	2012	
					thousand	1996 = 100%
1-9	630	373	355	194	118	18.7
10-19	199	144	122	74	52	26.1
20-49	146	133	112	74	51	34.9
50-99	38	48	43	21	21	55.3
100-199	12	21	21	15	10	83.3
200-499	3	8	9	7.4	8	170.2
> 500	1.7	2	2.3	2.7		
Total farms (thousand)	***1029***	***728***	***664***	***388***	***260***	***253***
Total pig livestock (thousand)	***20 418***	***18 707***	***18 512***	***15 278***	***11 581***	***56.7***

Source: own study based on GUS data (*Systematyka*... 2003; *Charakterystyka gospodarstw*... 2012; *Użytkowanie gruntów*... 2012).

The Eurostat data provide more information about the concentration of pig production in Poland and the selected EU countries (Table 6). In the EU-27, in 2010 over 70% of pigs were kept in holdings with over 1000 pigs for fattening. The figure for Poland stood at 25%, and it was lower only in Austria (13.7%). Romania has a very specific structure of pig production farms, since over 55% of pigs are kept on small farms with up to 9 pigs. At the same time, over one third of pigs are kept in large herds (over 1000 pigs). In the remaining EU countries, the majority of pig livestock, i.e. from 64% in Germany to 95% in Denmark, is kept in herds consisting of over 1000 animals, while the percentage of pigs kept in small herds is of no practical importance, except for Romania.

The average number of pigs for fattening kept on a farm varies significantly, from 1.9 in Romania to 505 in Denmark (Table 6). In Poland, on farms fattening pigs it was less than 17 pigs for fattening in 2010, while the EU average amounted to 22.6 animals.

The number of farms fattening pigs in 2003-2010 decreased in the EU by 43.7% on average and by 48.9% in Poland (Table 6). In individual countries the decrease varied from 28% in Austria to 77-79% in Italy, Czech Republic and Slovakia. This period saw a clear progress in concentration of production of pigs, as the number of farms keeping small herds of pigs (up to 10 animals) decreased by ca. 50%, while the number of farms keeping in excess of 400 pigs for fattening doubled.

The decrease of the population of pigs in Poland in the recent period could be tied to worse production results achieved by our farms in comparison to leading EU countries (Table 7). It could have an impact on poorer competitiveness of

our farms in the EU market, which has a consequence in substantial imports of breeding material (weaners) and live pigs.

Table 6

Pigs (%) in herds of various size and average number of pigs on a farm in Poland and the selected EU countries in 2010

Country	Size of pig herd (LU)								Average number on a farm	Decrease in the number of farms[a]
	1-2	3-9	10-49	50-99	100-199	200-399	400-999	> 1000		
Poland	0.9	3.6	21.1	13.9	13.4	11.1	10.8	25.3	16.6	48.9
Czech Republic	0.1	0.2	1.1	0.9	1.4	2.5	5.9	88.0	119.8	77.6
Slovakia	1.5	2.5	2.1	1.1	1.3	2.0	8.8	80.5	32.0	77.1
Austria	0.9	0.9	2.4	3.1	8.2	22.0	48.8	13.7	30.4	28.1
Denmark	0	0	0	0.1	0.2	0.6	3.6	95.5	506.1	35.1
France	0.1	0.1	0.3	0.3	1.1	4.2	17.1	76.8	45.0	53.9
Netherlands	0	0	0	0.1	0.6	2.3	8.8	88.2	243.0	34.4
Germany	0	0.2	0.8	1.2	2.7	6.3	25.2	63.6	127.6	41.2
Italy	0.1	0.5	1.3	0.7	0.9	1.5	5.6	89.5	42.9	78.9
Romania	32.6	23.0	8.9	0.8	0.4	0.2	0.5	33.6	1.9	35.9
EU-27	1.6	1.7	3.3	2.1	2.7	4.4	13.7	70.5	22.6	43.7

[a] 2003 = 100%.

Source: own study based on: (Agriculture in the European Union... 2013; Poczta W. 2012).

Table 7

Selected production results in pig raising in Poland and the selected EU countries

Specification	Poland	Denmark	Germany	Austria	EU-15
Number of sold pigs for fattening from one sow (LU/year)	15.5	25.6	22.5	21.7	23.0
Average number of litters per year	1.83	2.25	2.30	2.27	2.28
Feed consumption (kg) per 1 kg of body mass gain (in the period from weaning to sale)	3.42	2.66	2.92	2.92	2.89

Source: (Pejsak 2012, as in: Runowski H. 2014).

Specialisation in plant production

In 2010, 58% of all farms in Poland ran animal production, while this percentage ranged from ca. 80% in medium and larger farms (10-50 hectares of UAA) to 45% in the group of large farms – above 100 ha (Table 8). Also small farms, producing primarily for self-supply, more and more often discontinue keeping animals.

In medium and larger farms, with the exception of those specialising in horticulture, plant production alone does not ensure satisfactory level of income and only transformation of crops into animal products provides opportunities for fuller use of labour resources and generation of greater income. Therefore only around 20% of farms from this group did not carry out animal production and the average stocking density amounted to 0.8-0.9 LU per hectare. This group also includes numerous multi-directional farms, which – in parallel to plant production – often keep more than one species of animal. On large farms in turn, adequate mechanisation of field works facilitates achievement of high labour productivity and adequate level of income per one employed person and farm from plant production alone.

Table 8

*Animal population (LU*ha^{-1} UAA) on farms with various areas of UAA in 2010*

Utilised agricultural area in ha	Stocking density LU/hectare of UAA	Share (%) of farms running animal production
1-3	0.46	40
3-5	0.50	56
5-10	0.61	68
10-15	0.80	79
15-20	0.92	83
20-30	0.94	83
30-50	0.87	80
50-100	0.65	65
Above 100	0.19	45
Average	0.63	58

Source: own studies based on GUS data (*Charakterystyka gospodarstw...* 2012).

Table 9

The structure of land use in area groups of farms in 2010

Area group (ha)	Share (%)					
	land under crops	meadows	pastures	permanent crops	fallows	other
1-3	51.1	27.6	2.3	4.5	7.1	6.3
3-5	58.0	23.9	2.7	4.2	5.1	5.0
5-10	66.3	19.8	3.4	4.0	3.1	2.6
10-15	69.5	18.6	5.0	3.0	1.9	1.8
15-20	70.3	18.3	6.1	2.0	1.6	1.5
20-30	71.0	18.0	6.5	1.5	1.5	1.3
30-50	73.3	17.8	6.1	1.1	1.6	1.2
50-100	75.5	13.6	5.1	1.8	2.3	1.5
Above 100	77.7	10.6	3.4	1.2	3.2	3.7
Total	**69.4**	**17.5**	**4.4**	**2.6**	**3.0**	**2.8**

Source: own studies based on GUS data (Charakterystyka gospodarstw... 2012).

Table 10

The structure of crops (%) in various area groups of farms in 2010

Area group (ha)	Cereals	Oil crops	Potatoes	Sugar beet	Legumes		Maize for green matter	Other
					small grains	grain legumes		
1-3	78.2	2.2	8.8	0.4	2.8	1.7	0.8	5.1
3-5	80.6	2.4	6.5	0.4	2.5	2.0	1.1	4.7
5-10	81.2	2.8	5.0	0.7	2.4	2.0	1.8	4.2
10-15	79.4	3.6	4.1	1.5	2.8	1.9	3.6	3.2
15-20	77.0	4.5	3.6	2.1	3.2	2.0	5.0	2.6
20-50	73.2	7.5	2.8	2.8	3.4	2.1	6.2	2.1
50-100	69.4	13.6	2.1	2.9	3.5	2.7	4.1	1.9
Above 100	62.9	20.4	2.0	2.8	3.3	2.1	3.7	2.8
Total	**73.4**	**9.1**	**3.6**	**2.0**	**3.0**	**2.1**	**3.7**	**3.1**

Source: own studies based on GUS data (*Charakterystyka gospodarstw*... 2012).

Discontinuation of animal production has an impact on the structure of land use and structure of crops (Table 9-11). The largest farms were distinguished by a smaller share of meadows, pastures and permanent crops and clearly larger share of arable land (land under crops). Oil crops had a very large share on their crop structure (more than 20%), the share of sugar beet was also substantial, with a relatively lower share of cereals. Cereals were dominated by species with a higher market value (wheat – 44% and maize for grain – 12%) with a marginal share of feed cereals – triticale, cereal mixes and oats (Table 11).

The situation was different in the group of medium and larger farms (10-50 ha). In this group of farms practically all land was agriculturally used (fallows represented 1-2%), the share of permanent grassland was relatively high, while maize harvested for silage had a relatively high share in the structure of crops (Table 9 and 10). There are attempts at compensating negative results of a large share of cereals (above 75%) in the structure of crops with an increased share of species with smaller crop rotation requirements (triticale, rye and cereal mixes), which at the same time provide feed grains (Table 11).

In case of small farms (1-10 ha) and particularly the smallest ones (1-5 ha) one can hardly talk about rational farming. The share of land under crops was very small, with a large share of meadows, fallows and permanent plantations (Table 9-11). Around 80% of arable land was sown with cereals with predominance of extensive species (rye, oats and cereal mixes). Growing potatoes for own needs was also popular.

The process of plant production concentration was analysed in more depth on the examples of rape, sugar beet, potatoes and field vegetables (Table 12-15).

In 2002-2010 the area of rape cultivation in Poland increase from 439 to 946 thousand ha, the number of farms growing this plant also doubled from 43 to 86 thousand (Table 12). The area structure of rape plantations did not change though. The share of small farms, with average size of plantations of this plant not exceeding 2 hectares, in the total area of rape plantations in Poland amounted to ca. 2.5% in both analysed years, while ca. 60% of rape was cultivated on larger farms, where the average size of a plantation exceeded 20 ha.

Table 11

The structure of cereal crops on farms of various sizes in 2010 (100% – total cereals)

Area group (ha)	Wheat	Rye	Barley	Oats	Triticale	Cereal mixes	Maize for grain	Buckwheat and millet
1-3	27.9	14.2	10.7	9.8	16.4	17.7	1.9	1.4
3-5	23.0	16.3	11.3	10.5	17.0	18.6	1.7	1.6
5-10	19.8	17.6	11.8	9.9	18.5	19.5	1.6	1.3
10-15	19.1	16.3	12.5	9.0	19.9	20.4	1.7	1.1
15-20	20.4	14.8	13.1	8.1	20.6	19.9	2.1	1.0
20-50	26.0	11.9	14.2	6.7	20.3	16.4	3.4	1.2
50-100	35.1	11.2	13.7	6.1	17.0	8.4	6.0	2.5
Above 100	44.1	11.2	12.8	4.3	11.5	2.2	11.7	2.2
Total	**27.9**	**13.9**	**12.8**	**7.5**	**17.4**	**14.4**	**4.5**	**1.5**

Source: own studies based on GUS data (*Charakterystyka gospodarstw*... 2012).

Table 12

Area structure of rape plantations in Poland in 2002-2010

Specification	Farms growing sugar beet					
Rape growing area on a farm (ha)	2002			2010		
	number (thousand)	area under crops		number (thousand)	area under crops	
		thousand ha	%		thousand ha	%
0-1	5.7	1.4	0.3	7.0	4.2	0.4
1-2	7.2	9.5	2.2	14.0	19.8	2.1
2-5	16.6	48.8	11.1	31.4	98.6	10.4
5-10	7.0	44.7	10.2	16.8	113.6	12.0
10-20	3.1	39.6	9.0	8.7	116.3	12.3
Above 20	3.4	295.0	67.2	7.8	593.5	59.1
Total	**43.0**	**439.0**	**100**	**85.7**	**946.1**	**100**

Source: own study based on GUS data (*Systematyka*... 2003; *Charakterystyka gospodarstw*...2012).

Table 13

Area structure of sugar beet plantations in Poland in 2002-2010

Specification	Farms growing sugar beet					
Sugar beet growing area on a farm (ha)	2002			2010		
	number (thousand)	area under crops		number (thousand)	area under crops	
		thousand ha	%		thousand ha	%
0-1	21.3	8.2	2.7	11.7	3.6	1.7
1-2	33.3	42.2	13.9	10.3	14.5	7.0
2-5	36.5	100.3	33.1	20.7	61.3	29.7
5-10	7.2	44.1	14.5	5.7	36.2	17.5
10-20	2.95	108.2	35.7	1.7	21.4	10.4
Above 20	-			1.2	69.4	33.6
Total	101.3	303.0	100	51.3	206.4	100
Average plantation size (ha)		2.99			4.02	

Source: own study based on GUS data (*Systematyka*... 2002; *Charakterystyka gospodarstw*...2010).

The average size of rape plantations in Poland in years under analysis was similar and amounted to 10-11 ha, while in the EU-27 countries it was more than twice as large (Poczta W. 2012).

The area of sugar beet cultivation decreased by ca. 30% in 2002-2010, while the number of farms growing this plant decreased by ca. 50% (Table 13). There were also changes in the area structure of beet plantations – the number of small plantations (up to 2 ha) decreased from 55 to 22 thousand, while the number of large plantations (above 20 ha) increased. In the agricultural census of 2002 information on such plantations was not specified, but in 2010 this group of producers already grew more than 69 thousand of sugar beet, i.e. 1/3 of the entire area in the country. One could think that production quota could be a factor slowing down the pace of concentration of sugar beet growing.

The average size of sugar beet plantation in Poland in 2002-2010 increased from 3 to 4 ha (Table 13). It is still a very small area against the backdrop of EU countries, as in 2010, in the EU-15 the average size of sugar beet plantation amounted to 11.3 ha, while in the EU-12 it was 5.4 ha (Poczta W. 2012).

The number of farms growing potatoes decreased in Poland in 2002-2010 from 1.56 million to 748 thousand, while the area on which it was grown decreased from 803 to 388 thousand ha (Table 14). In both years under analysis, nearly 50% of all area under potatoes was located in small farms, producing primarily for self-supply, with the average size of a plantation not exceeding 1 ha. Such farms represented 85-90% of all farms growing potatoes. There were certain changes to the structure of farms with larger (above 1 ha) potato plantations. In 2002-2010, the number of larger plantation (above 10 ha) increased,

as did their share in the total area under potatoes from 5 to 19%, at the expense of smaller commercial plantations (1-5 ha).

The average size of potato plantations in Poland in 2002-2010 did not change and amounted to 0.52 ha (Table 14), in the EU in 2010 – 3.0 ha, while in the EU-12 countries the production of this plan was even more fragmented than in Poland – only 0.4 ha (Poczta W. 2012). The smallest plantations (0.1-0.3 ha on average) were located in Bulgaria, Romania and Hungary.

Table 14

Area structure of potato plantations in Poland in 2002-2010

Specification	Farms growing potatoes					
Potato growing area on a farm (ha)	2002			2010		
	number (thousand)	area under crops		number (thousand)	area under crops	
		thousand ha	%		thousand ha	%
Below 0.25	598.3	78.8	9.8	354.4	47.9	12.3
0.25-0.50	382.2	124.6	15.5	213.1	66.4	17.1
0.50-1.0	348.0	203.4	25.3	114.8	66.5	17.2
1-2	169.4	196.3	24.4	39.4	49.3	12.6
2-5	50.3	128.9	16.0	19.2	54.9	14.1
5-10	5.4	33.4	4.2	4.6	30.2	7.8
10-20	1.10	13.4	1.7	1.46	18.9	4.9
Above 20	0.40	24.6	3.1	0.84	54.2	14.0
Total	1555.2	803.4	100	747.7	388.3	
Average plantation size (ha)		0.52			0.52	

Source: own study based on GUS data (Systematyka... 2003; Charakterystyka gospodarstw...2012).

Table 15

Area structure of field vegetable plantations in Poland in 2002-2010

Specification	Farms growing vegetables					
Vegetable growing area on a farm (ha)	2002			2010		
	number	area under crops		number	area under crops	
	(thousand)	thousand ha	%	(thousand)	thousand ha	%
Below 0.10	392.1	14.8	8.7	30.8	1.2	1.2
0.10-0.50	162.0	27.1	15.8	35.3	7.8	5.6
0.50-1.0	25.0	15.6	9.1	13.4	9.2	6.6
1-2	19.9	25.5	14.9	13.4	18.2	13.0
2-5	13.8	39.5	23.1	11.8	35.5	25.4
Above 5	4.5	48.9	28.5	5.5	67.6	48.5
Total in Poland	617.1	171.3	100	110.2	139.5	100
Average plantation size (ha)		0.28			1.27	

Source: own study based on GUS data (*Systematyka*... 2003; *Charakterystyka gospodarstw*...2012).

The results shown in Table 15 evidence very fast progress of concentration of vegetable growing. In 2002-2010, the number of farms growing vegetables decreased from 617 to 110 thousand, while the area of their cultivation decreased by 18% (from 171 to 139 thousand ha). In this period the number of farms with small plantations of vegetables (below 0.5 ha) decreased from 554 to 66 thousand, while their share in the entire area under vegetables decreased from 24.5 to 6.8%. The share of commercial vegetable plantations with the area in excess of 5 ha in the entire area of their cultivation increased from 28 to 48% over the same period. The data clearly show that in a very labour intensive production, which vegetable growing is, small plantations based on manual work disappear quickly, while production is taken over by larger farms, which are able to mechanise entire production cycles.

Average vegetable plantation size in Poland increased from 0.28 in 2002 to 1.28 ha in 2010. The area is close to the average for the EU-27 and substantially larger than in the EU-12 (Poczta W. 2012).

Summary

Concentration of production and specialisation of farms is indispensable for economic and organisational reasons. It determines increased productivity, improvement of economic situation of farms and easier sales of crops, as large agri-food processing facilities are not interested in purchasing small lots of raw materials from fragmented suppliers due to higher costs and troublesome organisation of purchasing. It is a worrying phenomenon that – in our conditions – what grew was the number of farms without livestock where permanent grasslands are not properly used, which in turn lowers their environmental and production significance. In case of such farms it is also difficult to retain the sustainable balance of soil organic matter, which may limit fertility of soils and increase CO_2 emissions.

In case of farms specialising in animal production, in our conditions population of animals is often too large in relation to the utilised agricultural areaowned. In such situation excessive amounts of natural fertilisers are generated, which creates a risk of contamination of ground waters with nitrogen and phosphorus compounds. In addition, in case of keeping ruminants, in years with lower crops there may be shortages of roughage, which may lead to a collapse of financial results of farms. The situation could be improved through establishing better conditions for the flow of land from failing farms to prospective ones.

The analysis of the status of concentration of animal production in the leading EU countries leads to the conclusion that in our conditions such a high concentration in keeping livestock is inadvisable. This results from environmental reasons – large share of protected areas, strongly mosaic landscape pattern, substantial share of light soils, more susceptible to biogen losses, as well as relatively large labour resources in rural areas (Krasowicz S. et al. 2009; Matyka M. et al. 2013). In our conditions, particularly for southern and eastern parts of the country, the model of development of agriculture adopted in Austria would be more favourable.

References

Charakterystyka gospodarstw rolnych. Powszechny Spis Rolny 2010. GUS, Warsaw 2012.

Chechelski P., Grochowska R., Wigier M.: *Wyzwania i ograniczenia długookresowego rozwoju rolnictwa i obszarów wiejskich w Polsce*. Program Wieloletni 2011-2014, no. 42. IERiGŻ-PIB, Warsaw 2012.

European Union: Agriculture in the European Union – Statistical and economic information. Report 2013.

Gospodarstwa rolne w Polsce na tle gospodarstw Unii Europejskiej – wpływ WPR (ed. W. Poczta). Powszechny Spis Rolny 2010. GUS, Warsaw 2012.

Józwiak W., Michna W., Mirkowska Z.: *Procesy zachodzące w rolnictwie polskim w latach 1990-2010, projekcja na rok 2013 i pożądana wizja rolnictwa w 2020 roku – zagadnienia wybrane*. Program Wieloletni 2011-2014, no. 21. IERiGŻ-PIB, Warsaw 2011.

Krasowicz S., Stuczyński T., Doroszewski A.: *Produkcja roślinna w Polsce na tle warunków przyrodniczych i ekonomiczno-organizacyjnych*. Studia i Raporty IUNG-PIB, no. 14, 2009.

Kuś J.: *Specjalizacja gospodarstw rolnych a zrównoważony rozwój rolnictwa*. Program Wieloletni 2011-2014, no. 19. IERiGŻ-PIB, Warsaw 2013.

Kuś J.: Specjalizacja w rolnictwie jako element zwiększający ryzyko w produkcji i sposoby przeciwdziałania. *Zagadnienia Doradztwa Rolniczego, no. 1*(67), 2012.

Kuś J., Kopiński J.: Gospodarowanie glebową materią organiczną we współczesnym rolnictwie. *Zagadnienia Doradztwa Rolniczego, no. 2*(68), 2012.

Matyka M., Krasowicz S., Kopiński J., Kuś J.: Regionalne zróżnicowanie zmian w produkcji rolniczej w Polsce. *Studia i Raporty IUNG-PIB, no. 32*(6), 2013.

Rocznik Statystyczny Rolnictwa 2001. GUS, Warsaw 2001.

R*ocznik Statystyczny Rolnictwa 2013*. GUS, Warsaw 2013.

Runowski H.: Ekonomika rolnictwa – przemiany w gospodarstwach rolnych [in:] *Rolnictwo, gospodarka żywnościowa, obszary wiejskie – 10 lat w Unii Europejskiej*. Wydawnictwo SGGW, Warsaw 2014.

Systematyka i charakterystyka gospodarstw rolnych 2002. GUS, Warsaw 2003.

Użytkowanie gruntów, powierzchnia zasiewów i pogłowie zwierząt gospodarskich w 2012 r. GUS, Warsaw 2012.

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