

**COMPETITIVE POSITION OF THE POLISH FARMS  
AIMED AT PIG FARMING**

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**Abstrakt**

*The article presents the situation of the Polish farms specialising in pig farming in comparison with analogous ones in Germany, Denmark, the Netherlands and Spain. The assessment covered the production and economic activity of farms targeted at live pig production was assessed and determination of their effectiveness and competitiveness as well as the possibilities of their development. The analysis showed that the main factor determining the production efficiency and competitiveness of pig farms is the production scale, and among large and very large farms only Polish and Spanish farms were fully competitive.*

*The paper also indicates the main reasons for the weakness of the Polish pig production sector, which were identified as low degree of concentration and lack of links between livestock producers and processing plants and the existence of barriers hampering investments in livestock buildings adapted to a larger scale of production. In addition, the paper formulates the methods and directions of possible corrective actions in the field.*

**Keywords:** pig farms, competitiveness, specialization.

**JEL codes:** D2, D24, D3, D33, O13.

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## Introduction

Already in the interwar period, Poland was an important exporter of pig livestock to Great Britain (Blicharski and Hammersmeister, 2013), also in the post-war period production of pig livestock played a significant role in the Polish agriculture. In 1975-1979 and 1990-1994, the pig population was over 20 million heads, but in 2007-2016 it dropped drastically (over 37%). As a result, the share of pig livestock in livestock production decreased from 37.6% in 2007 to 22.6% in 2016. In the same period, a negative balance of foreign trade in pork was recorded both in terms of value and quantity, with more than 15-fold increase in import of live animals.

Determinants of directions of changes occurring in agricultural production, also in pig farming, are the price relations of production factors and agricultural products. From the mid-nineties, sales prices of pigs have been increasing more slowly than labour costs in the national economy and prices of means of production for agriculture (including feed): labour costs in the national economy increased more than five times (where wages are the main component), costs of means of production for agriculture over three times, and sales prices of agricultural products more than two times. This resulted in a reduction of the price scissors ratio in the analysed period to 70%: the growth rate of prices of means purchased by farmers was, therefore, 30% higher than prices of agricultural products (Ziętara, 2016). These unfavourable trends, in recent years strengthened by the moratorium on export to Russia and the emergence of African swine fever, justify the need to look for ways to stop the fall of this branch of agricultural production.

## Place and role of pig livestock production in Poland

Since the entry into the European Union, the growth of marketable agricultural production and important changes in its structure have been observed in Poland. In 2000-2016, this increase amounted to 128.5% and concerned plant production to a greater extent. In 2000, the share of pig livestock production in livestock production was 37.6%, but in subsequent years, despite the quantitative increase, its share decreased to 22.6% in 2016 (Table 1).

Table 1

*The structure of marketable agricultural production in Poland in 2000-2016*

Specification	2000		2010		2016	
	PLN million	%	PLN million	%	PLN million	%
Marketable agricultural production	33,491.4	-	59,357.1	-	76,546.2	100.0
Rate of change (2000=100)	100.0	100.0	177.2	100.0	228.5	100.0
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including:						
Livestock production	20,950.4	62.6	33,240.8	56.0	44,574.4	58.3
Rate of change (2000=100)	100.0		158.7		212.7	
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including:						
Pig livestock production	7,885.7	23.5	8,191.1	13.8	10,099.2	13.2
Rate of change (2000=100)	100.0	37.6 <sup>a</sup>	103.9	24.6 <sup>a</sup>	128.1	22.6 <sup>a</sup>

<sup>a</sup> the share in livestock production

Source: GUS (2017).

The removal of barriers in food trade between Poland and the other EU countries revealed high price competitiveness of many Polish food commodities, mainly beef, poultry meat and dairy products. Total balance of the Polish foreign trade was negative but it did not concern agri-food products for which in 2009-2016 it was positive. Unfortunately, the balance was still negative in trade in pork and live animals both in terms of quantity and value (Table 2). Piglets and weaners were imported mainly from Denmark, the Netherlands and Germany.

Table 2

<i>Foreign trade in pork and pig livestock</i>								
Specification	2009	2010	2014	2015	2016	2017		
Export (thousand tonnes) in meat equivalent	336.0	418.0	692.8	719.0	768.8	836.7		
Import (thousand tonnes)	614.0	602.0	847.7	854.1	880.4	907.7		
Balance (in terms of quantity thousand tonnes)	-278.0	-184.0	-154.9	-135.1	-111.6	-71.0		
Balance (in terms of value EUR million)	-524.5	-336.0	-350.2	-197.4	-188.6	-175.9		
Trade in pigs (live animals in thousand head in 2007-2013)								
	2007	2008	2009	2010	2014	2015	2016	2017
Export	434.0	418.8	442.2	274.4	85.5	38.9	60.1	82.7
Import	401.7	1124.6	1997.5	2285.3	5486.1	5568.7	6370.9	6821.5
Balance	32.3	-709.8	-1155.3	2011.1	-5401.6	-5229.8	-6310.8	-6738.8

Source: GUS (2015, 2017); *Handel zagraniczny* (2011, 2018).

### Research methods and sources

The presented research results are to serve for the assessment of production and economic activity of the Polish farms focused on the production of pig livestock and the determination of their effectiveness and competitiveness, and the possibility of their development compared to analogous farms in the selected European Union countries. The comparison covered the Danish, German, Spanish and Dutch farms. These countries are the leaders in the production of pig livestock in the EU. The basic source of research materials was statistical data and data from pig farms covered by the Polish and European FADN in 2014-2016, divided into five groups according to the economic size (Table 3). A descriptive and comparative method was used in the paper.

Table 3

*The number of studied groups of pig farms in 2014-2016*

SO classes in EUR thousand	Poland	Denmark	Netherlands	Spain	Germany
Pig farms (type 45)					
8-25 (2 <sup>nd</sup> Small)	15-40	-	-	-	-
25-50 (3 <sup>rd</sup> Medium-small)	100-200	-	-	-	-
50-100 (4 <sup>th</sup> Medium-large)	100-200	-	-	15-40	15-40
100-500 (5 <sup>th</sup> Large)	200-500	40-100	40-100	100-200	500-1000
500 and more (6 <sup>th</sup> Very large)	15-40	200-500	40-100	40-100	100-200

Source: own study based on unpublished data of the European Commission.

The following research hypothesis was adopted: “The main factor determining the production efficiency and competitiveness of pig farms is the production scale.” In order to determine the competitiveness of farms, the Competitiveness Index (Wk) was used following Kleinhanss (2015). In this study, competitiveness is defined as the capacity of a farm to develop. This means a situation where the farm income covers the costs of own production factors. This approach is different from the traditional definition of competitiveness as gaining an advantage (cost, price, quality, etc.) in relation to competitors (Stankiewicz, 2003). The adopted competitiveness index allows determining various degrees of competitiveness, which enables a more complete assessment of the development capacity of farms. Agricultural farms from different countries do not compete directly on the EU and global markets. The exception is trade in live animals (piglets and weaners). Trade and processing companies compete on these markets. Their effects are determined, e.g. by the raw material costs whose share in total production cost of meat and its products is 2/3 (Woś, 2003). Therefore, it is appropriate to determine the competitiveness of farms as the capacity to develop in the market conditions of a given country.

### **Changes in the pig population in Poland and in the selected countries**

In 1990-2007, the pig population in Poland was stable and remained at the level of about 18 million heads, with slight fluctuations of around 5% (Fig. 1). Since 2007, a steady downward trend has been observed, which resulted in the achievement of the level of 10.8 million heads in 2016 (a decrease of 40% compared to 2007).

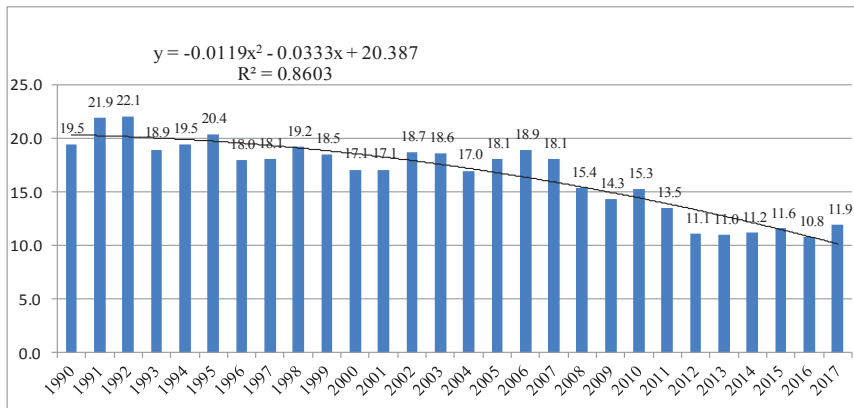


Fig. 1. Pig population in Poland in 1990-2017.

Source: GUS (1997-2018).

At the same time, a strong territorial diversity of the pig population is noted. In 1990, the largest share in the pig population in Poland was recorded in the Wielkopolskie Voivodeship (17.2%), followed by Mazowieckie (12.9%), Kujawsko-Pomorskie (9.3%), Podlaskie (7.6%) and Lubelskie (7.4%) Voivodeships. The above-mentioned regions covered almost 55% of the national population. In the following years, there were changes as a result of which in 2016 five voivodeships accounted for 71.1% of the pig population: Wielkopolskie (35.3%), Kujawsko-Pomorskie (10.6%), Łódzkie (9.9%), Mazowieckie (8.4%) and Pomorskie (6.9%). The dominant share of the Wielkopolskie Voivodeship deserves special mention. The pig population was very low in the following voivodeships: Lubelskie, Małopolskie, Podkarpackie and Świętokrzyskie (Zięta and Mirkowska, 2018).

Table 4

*Changes in the pig population structure in Poland in 2007-2016 (in thousand head)*

Specification	2007	2010	2012	2016
Pig population	18,100.00	15,278.10	11,581.32	11,900.00
Pig population in herds up to 50 heads	6,208.30	3,936.47	2,710.02	2,023.00
Pig population in herds of 50-200 heads	6,552.20	4,161.43	2,849.00	2,582.30
Pig population in herds of >=200 heads	5,339.50	7,180.71	6,022.30	7,294.70
Decrease in pig population in herds up to 200 heads	-	-4,662.60	-7,201.48	8,155.20
The rate of decrease (%)	100.0	-36.50	-56.43	-63.40
Increase in pig population in herds of >200 heads	-	1,841.21	682.8	1,955.20
The rate of increase (%)	100.0	34.50	12.78	36.61

Source: GUS (2015, 2018, 2011b).

The factor associated with changes in the population is the scale of production. In 2007-2016, the decrease in the total number of these animals was 34.2%, while in herds of 200 heads and more, the population increased to 36.61%. In herds below 200 heads, there was a decrease of 63.4% (Table 4). The increase in the pig population in herds of 200 heads and more did not compensate for the drop in population in herds up to 200 heads. These numbers clearly indicate the role of the scale of production in shaping the pig population in Poland.

Changes in the number and structure of farms with this type of production correspond to changes in the pig population. The relevant data is shown in Table 5.

It should be emphasised that a significant decrease in the number of farms keeping pigs: in 2005, there were 701.7 thousand of them, while in 2016 – 172.2 thousand (decrease of 75.4%). In the same period, the pig population decreased 34.2%. At the same time, the average size of the herd per one farm increased, from 25.8 heads in 2005 to 69.1 heads in 2016. The increase was 167.8%. The structure of pig farms also changed at the time. The share of farms keeping 10 heads and more increased from 46.6% in 2005 to 60.2% in 2016. The share of population in these farms increased from 92.6% to 97.4%.

Table 5

*The number and structure of pig farms and pig population in Poland in 2005-2016*

Year	2005	2007	2010	2013	2016
The number of farms (thousand)	701.7	664.0	388.5	278.4	172.2
Rate (2005=100)	100.0	94.6	55.3	39.7	24.5
Pig population (thousand)	18,100.0	18,100.0	15,300.0	11,000.0	11,900.0
Rate (2005=100)	100.0	100.0	84.5	60.8	65.7
Average herd size (head)	25.8	27.1	39.3	39.5	69.1
----- Structure of farms (%) -----					
1	11.1	10.6	9.6	11.8	
2	14.4	15.4	12.3	12.7	14.4
3-4	12.7	12.4	10.8	10.4	
5-9	15.2	15.1	15.0	14.4	25.4
10 and more	46.6	46.5	52.3	50.7	60.2
Total	100.0	100.0	100.0	100.0	100.0
The share of pig population in herds of 10 heads and more	92.6	93.3	95.6	95.7	97.4

Source: GUS (2017).

Until 2010, Poland was one of the leading producers of pig livestock in the European Union, taking third place in terms of the pig population, after Germany and Spain (Table 6). In 2016, with a population of 11.1 million heads, it fell to the sixth place (after France). During that period, the pig population in Poland decreased to 24.7%, while in Spain and Germany it increased to 13.6% and to 1.7%, respectively. In Denmark and the Netherlands, it decreased slightly, to 0.1% and 2.7%, respectively. In that period, there was also a decrease in the sow population, the largest in Poland, of 36.9%. In Germany and the Netherlands, 15.8% and 7.7%, respectively. The smallest decrease in the sow population occurred in Spain – 1.74% and in Denmark, where it was 4.7%.

Table 6

*Changes in the pig population in Poland and in the selected countries in 2010-2016*

Country	Pigs in total (thousand head)			Sows (thousand head)		
	2010	2016	2010=100	2010	2016	2010=100
Denmark	12,293	12,281	99.9	1,297	1,236	95.3
Germany	26,901	27,376	101.7	2,265	1,908	84.2
Spain	25,704	29,232	113.7	2,458	2,415	98.2
Netherlands	12,206	11,881	97.3	1,107	1,022	92.3
Poland	14,776	11,107	75.2	1,362	859	63.1

Source: Statistisches Jahrbuch (2017).

There were significant differences between the analysed countries in the structure of pig farms and pig population. In Poland, the share of farms keeping herds up to 200 heads in 2013 amounted to 97%, and 200 heads and more – only 3%. In Denmark and the Netherlands, the share of this group of farms was over 80%. The structure of the population was equally unfavourable in Poland. In Poland, herds of 200 heads and more included about 50% of the pig population, while in other countries more than 96%, and in Denmark and the Netherlands almost 100% of the population (Ziętara i Mirkowska, 2018).

Considerable differences were also noted in the level of concentration of pig farming as indicated by the numbers related to the average sizes of herds. In 2005, the average size of the herd in Poland was 25 heads, while in countries such as Denmark and the Netherlands 1500 and 1167 heads, respectively, and it was 60 and 47 times larger. In other countries, it was ranging from 197 heads (Spain) to 303 heads (Germany). In 2013, the differences deepened. That year the average herd size in Poland was 41 heads, while in Denmark and the Netherlands 3096 and 2208 heads, respectively, and it was 75 and 54 times larger (Ziętara and Mirkowska, 2018). The analysed countries had a higher degree of specialisation of farms than in Poland, with division into those focused on the “production” of piglets and animals for fattening. Large differences in pig stocking per 100 ha of UAA should be also pointed out. In Denmark and the Netherlands, it was within the range of 474 heads

(Denmark) and 679 heads (the Netherlands)<sup>1</sup>. In Germany, it was about 160 heads. In Spain, it showed an upward trend, from 85.3 in 2005 to 111.3 heads per 100 ha of UAA in 2016. There was a decrease in stocking from 114 to 75.6 heads in Poland in these years (Ziętara and Mirkowska, 2018).

### **Competitiveness of the Polish pig farms depending on the scale of production in 2008-2016**

The subject of the analysis were farms specialising in the production of pig livestock covered by the monitoring of the Polish FADN in 2008-2016. The relevant numbers describing their competitive situation in relation to the herd sizes are presented in Table 7. In farms keeping about 5 and 12 sows, the competitiveness index was less than 1 and was in the range of 0.15-0.92. These farms were devoid of development opportunities. Farms with pig population of 100-200 LUs, keeping about 40 sows, demonstrated their ability to compete in all analysed years. They achieved positive income from management, income at the parity level and competitiveness index above 1, between 1.42 and 1.87, and in 2016 even 2.29. Farms with a pig population of 200-300 LUs and more than 300 LUs, keeping 70 sows and more than 130 sows, where the competitiveness index was higher than 2, can be considered fully competitive.

Table 7

#### *Efficiency of Polish specialised pig farms depending on the scale of production in 2008-2016*

Year	The size of the pig population LU/farm					
	Below 20	20-50	50-100	100-200	200-300	300 and more
The number of sows (head/farm)						
2008	5.70	13.78	27.67	44.46	82.91	204.60
2012	4.09	10.71	24.83	38.54	72.42	135.97
2015	5.63	12.33	26.37	40.38	56.24	134.24
2016	4.97	12.05	24.1	38.45	55.70	130.86
Competitiveness Index WK						
2008	0.28	0.54	0.98	1.49	2.06	2.97
2012	0.40	0.92	1.51	1.87	2.18	3.63
2015	0.15	0.50	0.87	1.42	1.67	2.96
2016	0.35	0.90	1.51	2.29	3.38	4.22

Source: Goraj, Bocian, Osuch and Smolik (2010, 2014); Bocian, Osuch i Smolik (2017, 2018).

<sup>1</sup> Such a high pig stocking in these countries was the result of a large scale of farming (large herds) conducted on the basis of fodder of industrial origin from purchase, with a very loose relation to the ground. Animal faeces from these farms were used by other farms, usually without inventory.



### **Competitiveness of the Polish pig farms compared to selected countries**

Competitiveness indices in Table 8 show that no farm in the 2<sup>nd</sup> to 4<sup>th</sup> class has the ability to compete and develop. On the Polish farms, the value of this index was ranging from 0.14 (2<sup>nd</sup> class) to 0.65 (4<sup>th</sup> class). In the 4<sup>th</sup> class, the highest value of this index was obtained by the Spanish farms. It was 0.98 and was close to the lower value indicating the ability to compete. On the German farms, the value of the index in this class was very low, it was only 0.07.

In the 5<sup>th</sup> class, only the Polish and Spanish farms were able to compete – the values of the competitiveness index were 1.16 and 1.45, respectively. In the 6<sup>th</sup> class, farms in these countries were fully competitive. Their values of competitiveness indices amounted to 2.26 and 3.66, respectively. The Danish and Dutch farms in the 5<sup>th</sup> and 6<sup>th</sup> class did not have the ability to compete. Their index values were very low and did not exceed 0.16 (Danish in the 5<sup>th</sup> and 6<sup>th</sup> class and Dutch in the 5<sup>th</sup> class). A higher value of the competitiveness index was obtained by the Dutch farms in the 6<sup>th</sup> class, which amounted to 0.9. Also the German farms in the 5<sup>th</sup> class did not have the ability to compete<sup>2</sup>. The farms from this country in the 6<sup>th</sup> class, in which the value of the competitiveness index was 1.07, showed a minimum ability.

The size of pig herds per one farm increased with the increase in the economic size of farms. On the Polish farms, it was between 14.3 and 839 LUs. The degree of differentiation between countries was not high. In the 6<sup>th</sup> class, the smallest herds were on the German farms, with 593 LUs, whereas the largest on the Spanish farms, with a herd of 1048 LUs.

The production structure in all groups of farms was dominated by livestock production. Its share was between 68% (Poland) and 97% (the Netherlands). Spanish and Dutch farms were among the most specialised farms. The share of plant production was the highest on the Polish farms, in the 2<sup>nd</sup> to 4<sup>th</sup> class. It was in the range of 31.5-24.6%. In the 4<sup>th</sup> class, the share of plant production was also high on the German farms, at around 26%. The share of plant production was very low on the Spanish and Dutch farms, ranging from 1.6% to 13%. The share of remaining production in the majority of countries was small and did not exceed 7%. It was more significant on the Spanish farms in the 4<sup>th</sup> class, in which it amounted to 19%.

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<sup>2</sup> Farms without the ability to compete may operate for a certain period in a situation when their owners (users) accept not a full payment of own factors of production used.

Table 8

*Competitiveness of pig farms depending on the scale of production  
in selected EU countries*

Specification	Economic size of farms (EUR thousand)				
	8-25 (2)	25-50 (3)	50-100 (4)	100-500 (5)	=>500 (6)
----- Competitiveness Index -----					
Poland	0.14	0.40	0.65	1.16	2.26
Denmark	-	-	-	0.16	0.16
Spain	-	-	0.98	1.45	3.66
Netherlands	-	-	-	0.16	0.90
Germany	-	-	0.07	0.66	1.07
----- Pig population (LU/farm) -----					
Poland	14.31	30.96	62.14	172.40	838.57
Denmark	-	-	-	237.40	1107.15
Spain	-	-	68.74	292.20	1047.56
Netherlands	-	-	-	270.70	1071.77
Germany	-	-	55.01	212.90	593.19
----- Share of livestock production in total production (%) -----					
Poland	68.00	72.20	75.00	79.90	76.50
Denmark	-	-	-	73.60	81.10
Spain	-	-	74.00	85.50	94.60
Netherlands	-	-	-	92.80	97.30
Germany	-	-	69.20	75.40	74.20
----- Cost of feed (EUR thousand/LU), including from purchase (%) -----					
Poland	0.77/(63.6)	0.75/(68.0)	0.72/(72.2)	0.66/(78.8)	0.64/(82.8)
Denmark	-	-	-	0.84/(88.1)	0.78/(85.9)
Spain	-	-	0.43/(97.7)	0.32/(75.0)	0.30/(100.0)
Netherlands	-	-	-	0.62/(100.0)	0.71/(100.0)
Germany	-	-	0.79/(77.2)	0.71/(83.1)	0.62/(91.9)
----- The share of subsidies in farm income (%) -----					
Poland	98.63	51.12	42.37	31.64	32.74
Denmark	-	-	-	154.74	215.40
Spain	-	-	16.83	13.77	5.68
Netherlands	-	-	-	25.89	9.03
Germany	-	-	276.88	56.03	70.23

Source: own study based on data of the European FADN.

Feed costs per 1 LU showed a declining trend with an increase in production scale. On the Polish farms, they were ranging from EUR 0.77 thousand to EUR 0.64 thousand per LU and were lower than the costs of feed in Danish, Dutch and German farms. Costs of feed were definitely the lowest on the Spanish farms where they were ranging from EUR 0.43 (4<sup>th</sup> class) thousand to EUR 0.30 (6<sup>th</sup> class) thousand per LU. They were about 50% lower than on Polish farms. The cost of feed was dominated by the costs of feed from purchase. On the large Dutch farms and on very large Spanish and Dutch farms, their share was 100%. On the remaining farms in the 4<sup>th</sup>-6<sup>th</sup> classes, their share was ranging from 72% to 97%.

An important factor affecting the level of farm income are all kinds of subsidies obtained by farmers in the framework of the Common Agricultural Policy. The share of subsidies in income is negatively correlated with the economic size of farms. On the Polish farms, this share was ranging from 97% (2<sup>nd</sup> class) to 32% (5<sup>th</sup> and 6<sup>th</sup> class). It was the highest on the German farms in the 4<sup>th</sup> class, where it amounted to 277%, and on the Danish farms in the 5<sup>th</sup> and 6<sup>th</sup> classes, where it was 155% and 215%, respectively. The lowest share of subsidies in farm income occurred on the Spanish farms, in which it was between 17% (4<sup>th</sup> class) and 6% (6<sup>th</sup> class), and on the Dutch farms in the 6<sup>th</sup> class, in which it amounted to 9%. It was the result of their small area.

### **Features of pig farms which are able to compete and are competitive**

The following features were taken into account in the characteristics of pig farms, which are able to compete and are competitive: economic size of farms, utilised agricultural area, the value of assets per annual work unit (AWU), the share of capital in liabilities, pig population on the farm (LU), stocking of animals in LU per 100 ha of UAA, production intensity level (total costs per ha of UAA) and feed costs in EUR thousand per LU. The values of these indicators are given in Table 9.

In line with the competitiveness index described earlier, farms where the value of this index was  $\leq 1 < 2$  were considered to be able to compete. The farms able to compete also include medium-large Spanish farms, where the value of this index was 0.98, close to 1. In addition to these farms, Polish and Spanish large and very large farms, and very large German farms showed their ability to compete. The economic size of this group of farms varied: Spanish farms were the smallest (EUR 72.68 thousand of SO), and German farms the largest (EUR 858.23 thousand of SO). The SO value on the large Polish farms in the class of 100-500 thou. was EUR 191 thousand of SO and was 34% smaller than on the Spanish farms and 78% smaller than on the German farms. The utilised agricultural area was also strongly diversified. Very large German farms had the largest area in this group – it amounted to 141.29 ha of UAA, and they were larger than the Polish and Spanish farms by 206% and by 302%, respectively, while compared to medium-large Spanish farms, they were about 8 times larger. The degree of differentiation in the value of assets was smaller. On the German farms the value was about EUR 474 thousand per AWU and was larger than on the Polish and Spanish farms 91% and 65%, respectively. It was 4 times larger than medium-large Spanish farms.

Table 9

*Features of pig farms which have the ability to compete and competitive in 2014-2016*

Economic size (EUR thousand of SO)	Poland	Spain	Germany
Competitiveness Index			
(4) 50-100	-	0.98	-
(5) 100-500	1.16	1.45	-
(6) ≥500	2.26	3.66	1.07
Economic size (EUR thousand of SO)			
(4) 50-100	-	72.68	-
(5) 100-500	191.15	289.37	-
(6) ≥500	921.25	1050.08	858.23
Utilised agricultural area (ha)			
(4) 50-100	-	18.15	-
(5) 100-500	46.17	35.71	-
(6) ≥500	215.95	44.15	141.29
Value of assets (EUR thousand/AWU)			
(4) 50-100	-	118.36	-
(5) 100-500	247.60	287.92	-
(6) ≥500	250.31	318.76	473.58
The share of capital in liabilities (%)			
(4) 50-100	-	98.50	-
(5) 100-500	90.30	93.50	-
(6) ≥500	79.70	87.75	63.62
Pig population (LU/farm)			
(4) 50-100	-	68.74	-
(5) 100-500	172.40	292.20	-
(6) ≥500	838.57	1047.56	593.19
Stocking of animals (LU/100 ha of UAA)			
(4) 50-100	-	390.90	-
(5) 100-500	378.20	830.60	-
(6) ≥500	388.57	2380.70	423.70
Total costs (EUR thousand/ha of UAA)			
(4) 50-100	-	3.45	-
(5) 100-500	3.18	3.71	-
(6) ≥500	3.76	10.98	5.81
Cost of feed (EUR thousand/LU)			
(4) 50-100	-	0.43	-
(5) 100-500	0.66	0.32	-
(6) ≥500	0.64	0.30	0.62

Source: as for Figure 8.

In line with the competitiveness index described earlier, farms where the value of this index was  $\leq 1 < 2$  were considered to be able to compete. The farms able to compete also include medium-large Spanish farms, where the value of this index was 0.98, close to 1. In addition to these farms, Polish and Spanish large and very large farms, and very large German farms showed their ability to compete. The economic size of this group of farms varied: Spanish farms were the smallest (EUR 72.68 thousand of SO), and German farms the largest (EUR 858.23 thousand of SO). The SO value on the large Polish farms in the class of 100-500 thou. was EUR 191 thousand of SO and was 34% smaller than on the Spanish farms and 78% smaller than on the German farms. The utilised agricultural area was also strongly diversified. Very large German farms had the largest area in this group – it amounted to 141.29 ha of UAA, and they were larger than the Polish and Spanish farms by 206% and by 302%, respectively, while compared to medium-large Spanish farms, they were about 8 times larger. The degree of differentiation in the value of assets was smaller. On the German farms the value was about EUR 474 thousand per AWU and was larger than on the Polish and Spanish farms 91% and 65%, respectively. It was 4 times larger than medium-large Spanish farms.

In terms of the share of capital in liabilities, German farms stood out as they used foreign capital to greater extent. Its share in liabilities was about 36%. However, on the other Polish and Spanish farms it did not exceed 10%.

The pig population was highly diverse. On the German farms it was 593 LU/farm and was 3.4 times larger than on the Polish farms, and 2 and 8.6 times, respectively, larger than on the Spanish farms. Such a large difference between German and other farms indicates low unit profitability of pig livestock production on the German farms. The differences in stocking of animals, which was dominated by pigs (99%), were not as large as in their population. It was the largest on the large Spanish farms, where it amounted to 830.6 LU/100 ha of UAA, and was about twice as large as on other farms. Such a high stocking of animals, exceeding between 2 times (Poland) and 4.9 times (Spain) the recommended stocking, namely 170 LU/100 ha of UAA, indicates that pig farming is loosely related to land. Animal faeces from such farms exceed the possibilities of agricultural management on farms where they were produced hence they had to be managed on other farms or used differently, e.g. for energy production in biogas installations.

The examined farms, with the ability to compete, differed also in the intensity of production. It was the highest on the German farms, where the total cost per 1 ha of UAA amounted to EUR 5.81 thousand/ha of UAA and was about 1.5 times higher than on other farms. The Spanish farms were distinguished by low feed costs, which on large farms amounted to EUR 0.32 thousand/LU and were two times lower than on the Polish and German farms. These was mainly fodder from purchase (>75%).

Very large Polish and Spanish farms were fully competitive with the competitiveness index equal to 2.26 and 3.66, respectively. Their economic size was similar, about EUR 1000 thousand of SO, whereas they definitely differed in area, which on the Polish farms was about 216 ha and was 5 times larger than on the

Spanish farms. This indicates a loose relationship between pig farming and the land on the Spanish farms. The value of assets on the Spanish farms was approximately EUR 319 thousand/AWU and was 27% higher than on the Polish farms. The analysed farms used foreign capital to a small extent. Its share was about 15%. The pig population was similar. On the Polish farms it was 836.6 LU and was 20% lower than on the Spanish farms. There were significant differences in the stocking of animals. On the Spanish farms it amounted to 2381 LU/100 ha of UAA and was over 6 times larger than on the Polish farms. Such a high stocking of animals on the Spanish farms, which exceeded the recommended level 14 times, indicates industrial farming of pigs. The level of production intensity on the Spanish farms was very high. It amounted to EUR 10.98 thousand/ha of UAA and was about 3 times higher than on the Polish farms.

The Spanish farms were distinguished by low feed costs, which amounted to EUR 0.3 thousand/LU and were 53% lower than on the Polish farms.

The analysis shows that the basic factor determining the competitiveness of pig farms is the scale of production.

### **Barriers to and directions of development of pig farming in Poland**

The analysis carried out indicates a highly unfavourable situation in the sector of pig livestock production in Poland. This is demonstrated by a drastic drop in pig population from 18.1 million heads in 2007 to 11.9 million heads in 2017 (decrease of around 38%), high negative balance of foreign trade in pork caused by very high import of live animals, mainly piglets and weaners. Due to this situation, Poland's production potential in the production of pig livestock is only used in around 50%. The reasons for the drop in the pig population are different, and their detailed specification is presented accurately by Dargiewicz (2018). The most important ones include:

- Administrative barriers hindering access to land for entrepreneurs conducting pig farming on a larger scale, they also apply to lessees.
- Lengthy administrative procedures related to obtaining permits for investment in livestock buildings for pigs, which are to a large extent the result of the lack of spatial development plans in the majority of municipalities and protests of the residents.
- The threat of infectious diseases and the resulting need for special safeguards related to biosecurity, which entails additional costs. Small-scale farms are not able to meet these requirements.
- A ban on the use of feed including raw materials originating from GMOs, mainly soya. The introduction of non-GMO substitutes will increase production costs, even up to 10%. Introduced moratoria on import of soya do not eliminate the uncertainty of producers.
- Increasing requirements of animal welfare also lead to increased production costs.
- Environmental barriers are related to the condition of management of 70% of effluent from pig farming (organic fertilisers) on land used (own and leased), the application of the Nitrates Directive according to which the maximum stocking

of animals cannot exceed 1.7 large heads per 1 ha of utilised agricultural area. The introduction of animal stocking restrictions is justified. However, the ban on the sales of organic fertilisers among farmers raises doubts. The introduction of a longer (6 months) storage period of slurry forces investments in reservoirs, which leads to higher costs.

- Organisational barriers resulting from very low level of concentration of pig farming. In 2016, the share of farms keeping 200 heads and more was only 4.5%. Low concentration of pig livestock production is the cause of very low bargaining position of producers in relation to purchasing enterprises (commercial and meat processing). The degree of both horizontal and vertical integration is also very low.

The analyses carried out so far clearly indicate that in the current economic and environmental conditions, the farms conducting pig farming in a professional manner, which is inextricably linked with a larger scale of production, have development opportunities. A condition for development of such farms is the elimination of existing barriers. The economic slaughter of pigs proposed by the Minister of Agriculture and Rural Development and small processing by farmers in farms will not contribute to the reconstruction of the pig population to the level of previously existing production potential, which was about twice as large as the current state (the Act of 9 November 2018). This market will have a niche. The basis for development can be professionally run farms with an appropriate production scale. Another condition is the deeper specialisation of farms, consisting in the separate production of piglets (up to a weight of about 25 kg) and fattening up to slaughter weight. The division of the pig livestock production process into these two phases will help to meet the environmental requirements. Fattening houses should be located in areas with lower population density. In order to limit the negative impact of pig farming on the environment, it is advisable to combine this production with biogas installations, this will allow reducing unpleasant odours, obtaining energy without losing the fertiliser value of animal manure.

An important factor in development of pig livestock production is both horizontal and vertical integration. A good example of using integration is the pig livestock production system in Spain, which has become the largest producer of pig livestock in the European Union in a dozen or so years. In Spain, feed companies which not only deliver feed but also provide veterinary and sales care, acted as an integrator. These are systemic solutions. Such solutions can also be found in Poland in the form of a contract system. An example is the feed company Agrifirm Polska which, being a feed producer, created a system of related companies supplying farmers with piglets and weaners for fattening, in fodder and providing for sales. The farmer uses own livestock buildings and own labour. The price is also guaranteed. This system is beneficial for farmers with livestock buildings because they do not have to involve their own funds to purchase an “input” for fattening and feed. This system is gaining more and more recognition among farmers, but it also has critics among political spheres claiming that it is unfavourable for farmers. A question should be asked at this point: what in return? what other solution? However, there is no answer to these

questions. Of course, the ideal solution would be to create such a system by farmers who would be owners of feed and meat companies. Such a system is functioning, e.g., in Denmark and the Netherlands, where farmers are members of cooperatives supplying them with means of production, operating purchasing centres and agricultural processing (dairies and meat establishments). It is virtually impossible to create such a pig livestock production system in Poland under current conditions. Former state-owned Meat Establishments were privatised. Feed mills also function as private companies. Purchasing and Marketing Cooperatives (Municipal Cooperatives) have mostly collapsed or changed their character. Certain solution which does not require large capital expenditures could be the horizontal integration of pig livestock producers by creating producer groups (in the form of cooperatives or limited liability companies). Thanks to this, their bargaining power would increase in relation to suppliers of means of production, mainly feed, and meat establishments.

### **Summary and conclusions**

The research supports formulation of the following conclusions:

- After 2007, a drastic (40%) drop in the pig population occurred in Poland on farms keeping herds up to 200 heads.
- Despite the decline in the pig population, the value of marketable production of pig livestock in 2000-2016 increased by 28.1%, with a simultaneous decrease in its share in marketable animal production of 15 percentage points, from 37.6% in 2000 to 22.6% in 2016.
- After 2007, there was a negative balance of foreign trade in pig livestock, mainly due to the import of live animals (piglets and weaners). In 2017, net import of this group of animals amounted to 6738.8 thousand heads. 2007 was the last year in which the balance was positive and amounted to 32.3 thousand heads.
- The level of concentration of pig farming on farms in Poland is very low compared to the leading producers of pig livestock, such as Denmark, the Netherlands and Germany. In 2013, on average 41 pigs were kept on the Polish farms, while in the above-mentioned countries it was 3096, 2285 and 584 heads, respectively. In 2016, the average size of a pig herd in Poland was 69.1 heads.
- Regional differences in the pig population increased. In 1990, it was 54% in five leading voivodeships, while in 2016 already 75.6%. The leading voivodeship in pig farming was Wielkopolskie, in which 35.3% of the total pig population was kept in 2016. The level of the pig population is drastically low in southern voivodeships: Małopolskie, Podkarpackie and Świętokrzyskie.
- Large differences were also related to the pig stocking per 100 ha of UAA. In 2016, the average stocking in Poland was 75 head per 100 ha of UAA, while in the Netherlands and Denmark 679 and 474 heads, respectively. Then in Poland, the highest stocking was recorded in the Wielkopolskie Voivodeship (227 heads), while in some districts of this voivodeship, i.e. Środa Śląska and Gostyń, 547 and 445 heads per 100 ha of UAA, respectively. These numbers indicate a huge development potential in the field of pig farming in Poland.



- The Polish farms keeping up to 25 sows are deprived of development opportunities. Currently, those which keep about 40 sows have them. At present, farms with 70 sows or more can be considered fully competitive. This limit will grow in the future.
- Research confirmed the accepted research hypothesis assuming that the main factor determining the efficiency of pig livestock production is the scale of its production.
- The Polish small and medium-small farms keeping pig herds of 14.3 and 31 LU/farm did not have developmental abilities. Their competitiveness indices amounted to 0.14 and 0.40, respectively.
- Also the Polish, Spanish and German medium-large farms keeping 62.1, 68.7 and 55.0 LUs did not have developmental abilities. Their competitiveness index amounted to 0.65, 0.98 and 0.07, respectively. The Spanish farms had the best chance of getting developmental abilities in this class.
- Among large farms, only the Polish and Spanish farms demonstrated the ability to develop and compete with their competitiveness indices of 1.16 and 1.45, respectively, and in which 172.4 and 292.2 LUs, respectively, were kept. The remaining farms: the Danish, Dutch and German, did not show the ability to develop. Their competitiveness index was 0.16, 0.16 and 0.66, respectively. The pig population on these farms was 237.4, 270.7 and 219.9 LUs, respectively. It can be described as high.
- From among very large farms, the Polish and Spanish farms were fully competitive with their competitiveness index of 2.26 and 3.66, respectively, and in which the pig population was 838.6 and 1047.6 LUs, respectively. Out of the remaining farms, the ability to compete was demonstrated by the German farms in which the competitiveness index was 1.07 and the pig population was 593.2 LUs. The Danish and Dutch farms did not show the ability to develop. Their competitiveness indices amounted to 0.16 and 0.90, respectively. The pig population in these farms was high, as it amounted to 1107.2 and 1071.8 LUs, respectively.
- The basic condition for the reconstruction of the pig population in Poland is the effective removal of the existing barriers hindering investment in livestock buildings adapted to a larger scale of production which enables professional production of pig livestock.

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## POZYCJA KONKURENCYJNA POLSKICH GOSPODARSTW NASTAWIONYCH NA CHÓW TRZODY CHLEWNEJ

### Abstrakt

Artykuł prezentuje sytuację polskich gospodarstw specjalizujących się w chowie trzody chlewnej na tle analogicznych w Niemczech, Danii, Holandii i Hiszpanii. Ocenie poddano produkcyjną i ekonomiczną działalność gospodarstw nakierowanych na produkcję żywca wieprzowego oraz określono ich efektywność i konkurencyjność oraz możliwości ich rozwoju. Dokonana analiza wskazała, że głównym czynnikiem decydującym o efektywności produkcji i konkurencyjności gospodarstw trzodowych jest skala produkcji, a wśród gospodarstw dużych i bardzo dużych w pełni konkurencyjnymi były tylko gospodarstwa polskie i hiszpańskie.

W artykule wskazano również podstawowe przyczyny słabości polskiego sektora produkcji trzody chlewnej, za które uznano niski stopień koncentracji i brak powiązań producentów żywca z zakładami przetwórstwa oraz istnienie barier utrudniających inwestowanie w budynki inwentarskie dostosowane do większej skali produkcji. Sformułowano ponadto sposoby i kierunki możliwych działań naprawczych.

**Słowa kluczowe:** gospodarstwa trzodowe, konkurencyjność, specjalizacja.

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