

CHANGES IN THE LIVE PIG MARKET IN DIFFERENT COUNTRIES

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**WULS Press
Warsaw 2017**

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The monograph was prepared as part of the project was funded by the National Science Centre on the basis of decision DEC-2013/09/B/HS4/03606.

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ISBN 978-83-7583-747-6

Warsaw University of Life Sciences Press
Nowoursynowska 166, 02-787 Warsaw, Poland
phone: (+48 22) 593 55 20 (-22; -25 – sales), fax (+48 22) 593 55 21
e-mail: wydawnictwo@sggw.pl

Print: POLIMAX s.c., ul. Nowoursynowska 161 L, 02-787 Warszawa

CONTENTS

<i>Elżbieta J. Szymańska</i> Preface	5
<i>Georgij Cherevko</i> Market of pork in Ukraine: state and prospects	7
<i>James W. Dunn</i> The evolution of the U.S. swine industry	19
<i>Monika Gębska</i> Legal and organizational aspects of the transport of pigs in Poland and selected eu countries	28
<i>Barbara Jarocka, Aneta Beldycka-Bórawska, Piotr Bórawski, James W. Dunn</i> Tendencies in production, structure of pig herds and Polish trade in pork	43
<i>Volodymyr Kovaliv, Iryna Kovaliv, Natalia Alokhina</i> Management problems of pig farming industry in Ukraine in the context of the establishment of free trade area with the European Union	57
<i>Agata Malak-Rawlikowska, Edward Majewski</i> Costs of compliance of pig farms in Poland and selected EU countries with the EU animal welfare and food safety legislation	68
<i>Joe L. Parcell, Glynn T. Tonsor, Ted Schroeder</i> Changing structure in the U.S. hog supply chain: implications for market price discovery	83
<i>Kinga Pércsi, Henrietta Nagy</i> Recent economic challenges in the Hungarian pig sector	98
<i>Henryk Runowski</i> Spatial differentiation of live pig production in the European Union	112
<i>Elżbieta J. Szymańska</i> Difficult situation in the pork market in Poland – reasons and proposed solutions	127
<i>Lesia V. Zaburanna, Kateryna L. Tuzhyk</i> Sustainability and corporate social responsibility in farms' strategies: a case study of pig farm in Ukraine	140
<i>Danuta Zawadzka</i> Pig market from 2000 to 2015 and its changes for 2016 and 2017	148



PREFACE

Pork is the main meat in the food market and there has been observed its intense growth globally. In the period 2005–2015 pork production increased by 14.6% in the world and amounted to 110.3 million tons in post-slaughter warm weight, which accounted for 42.8% of the total produced volume of meat (USDA). As predicted by the Food and Agricultural Policy Research Institute (FAPRI), the production of this type of meat will continue to increase in the next years, reaching in 2020 the level of 120.3 million tons.

The volume of production of pork bait depends on many global and local factors. The first group includes: macroeconomic determinants, demographic factors, and social policy of the state in the market economy, production efficiency, changes in the meat production chain, law rules, and climate changes. The regional factors include: the climatic conditions, the laws relating to animals and animal diseases.

The location of production of pigs is determined primarily by religious grounds and the feed resources required for the sustenance of this species. In this regard, there have been developed three major clusters of pork production in North America, Europe and Asia. The major producers of this type of meat are: China, the EU-28, USA and Brazil. In 2015, 92.9 million tons of pork was made in these countries, which accounted for 84.2% of world production.

A feature of the bait pork market is the variability of the market, growth of demand for pork, particularly in developing countries, the increasing intensification and concentration of production, the development of international trade, integration in the supply chain of pork, the volatility of exchange rates and emerging animal diseases such as porcine epidemic diarrhea (PED) and African swine fever (ASF).

The problem for the producers of bait pork is a higher demand for food, driven by growing population and high production costs, resulting from increasing fuels and energy, promotion of biofuels and weather risk. The most important criterion in economic decision-making becomes the maximization of economic efficiency. In addition, along with the development of world trade, the income of food industry largely depends on the success of the sales of raw materials in the international markets. Sanitary and veterinary standards often play the role of market protection tools.

Keeping in mind the importance of these issues, an attempt was made to identify changes in the bait pork market in some countries to identify the problems and prospects of its development. A detailed analysis was applied to countries like: USA, Ukraine, Hungary and Poland. The basis for the discussion was a scientific-practical conference, organized by the Warsaw University of Life Sciences – WULS-SGGW, in Faculty of Economic Sciences, Department of Economics and Organization of

Production on 20 October 2016 on “Challenges in the Pork Market in Poland Against the Background of the EU”. The result of the discussion was the collection of scientific developments in the form of monographs, prepared by scientific employees, experts from different countries, who in their research are engaged in demand, supply and consumption of pork. There were many factors as the topic of discussion, which were very important in shaping the economic situation on the market of live bait pork.

The development is targeted for a wide range of readers, because it has the character of not only cognitive, but also practical. Its analysis and conclusions may be useful for both producers of bait pork, entrepreneurs involved in the slaughtering of pigs and processing of pork, and decision makers that have influence on the shaping of agricultural policy in this market. I hope that a monograph will represent an immeasurable contribution to further research and development of solutions which ensure the development of production of live bait of pork in the world.

Elżbieta Jadwiga Szymańska

MARKET OF PORK IN UKRAINE: STATE AND PROSPECTS

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Abstract. The results of the state and prospects of pork market development investigation in Ukraine are presented. The state of the pig breeding and supply structure forming on the pork market are described. The results of branch export potential analysis are presented. Main directions of further development of internal and external markets of Ukrainian pork are substantiated. Research showed, that reform changes had a negative impact on the pig raising industry. Country lost the leading position among the world's pork producers. The priority of conceptual problems to be solved in the near future in order to revive the domestic industry and increase production of high quality pork.

Key words: market, pork, pigs, producers, import, export

INTRODUCTION

Potentially pig raising is one of the most effective area of agricultural business. In Ukraine it has long history and has been considered as a national industry. Today the state of pork production in Ukraine is catastrophic and uneconomical. The balance of foreign trade turnover is negative. The problems of pork production in Ukraine were actively investigated by the following scientists: V. Boyko, B. Danyliv, K. Hirnyak, V. Ivanyuta, H. Ilyina, P. Kaninsky, I. Kravets, L. Krasnokutska, O. Mazurenko, P. Makarenko, C. Prylipko, V. Rybalko, I. Svynous, Ye. Svyatkivska, I. Topiha, O. Shpychak, A. Shust, P. Schepiyenko and others. They explored a wide range of issues concerning the development of the industry and the market of its products. In particular, in articles of the named above authors results of research by them processes of forming of market of pork in Ukraine, influence of export – import operations and level of populations profits on this forming, separate economic and technological aspects of development of the domestic pig breeding as a factor of

forming of supply at this market are lighted up. However, the current dynamic situation requires to continue this research in terms of analysis of the current state pork market, identifying key factors that influence it, and justifying the measures for improvement in the future.

THE PURPOSE AND METHODOLOGY OF THE STUDY

The aim of the research is to identify the status and study the basic directions of further development of pork market in Ukraine. A descriptive method of its implementation, methods of synthesis and analysis, induction and deduction methods as well as time series analysis, comparison of dynamic data were used. Certain aspects of research were done on the basis of monographic method. The received data are presented in tabular and graphical form. As the main data sources the official general and of a particular branch statistical collections and annuals of State Service of Statistics of Ukraine, materials of publications on a theme of research, results of own supervisions and researches were used. The time of research engulfs the period of 2011–2016 years. The separate aspects of problem are examined for period of 2001–2016 years.

RESEARCH RESULTS

Modern pig livestock sector is a priority with a large production capacity. Piglets at age of 9–10 months can be used for breeding herd reproduction and growing offspring receiving annually up to 20 or more metric canters per pig live weight from one sow. Pigs are omnivorous animals. They are fed with vegetables, corn or food wastes. These factors contribute to pigs breeding in different climatic conditions, households and farms. In addition, 1 kg of live weight gain of pigs consumed less feed units compared to other farm animals [Maslak 2016].

In Ukraine, favourable factors for the development of pig production are the following:

- rich harvest of grain and corn;
- relatively low wages;
- experienced farmers;
- consumption of pork for centuries as bacon (fat) is generally considered as a Ukrainian national product.

Saturation of pork market in Ukraine regarding the potential needs of 60–75%, or at least a third of it is a reserve for its expansion. However, the current pork market

today does not meet the existing needs of the population because of systematic and stable folding area (Table 1). During 2011–2016 Ukraine is the home not only of sebaceous pig breeds (white great breed and white Ukrainian breed) but the world's only monument to a pig [Svynous 2014].

Table 1. Dynamics of pigs raising in Ukraine, in selected years (thousand heads)

Specification	2001	2011	2013	2014	2015	2016	2016–2001 = 100%
All categories of farms							
Pigs	7 652.3	7 960.4	7 576.7	7 922.2	7 350.7	7 079.0	92.5
including sows	558.6	517.8	487.9	502.0	478.0	525.5	94.1
Agricultural companies							
Pigs	2 414.4	3 625.2	3 556.9	3 878.9	3 732.8	3 704.0	153.4
% to the total number	31.5	45.5	46.9	49.0	50.8	52.3	20.8
including sows	308.0	252.1	240.6	252.5	260.8	325.4	129.1
% to the total number	55.1	48.7	49.3	50.2	54.6	61.9	6.8
Households							
Pigs	5 237.9	4 335.2	4 019.8	4 043.3	3 617.9	3 375.0	64.4
including sows	250.6	265.7	247.3	249.5	217.2	200.1	79.8

Source: own study based on SSSU data [Animal... 2016].

During the period of last 15 years the number of pigs in Ukraine decreased overall by almost 8%, including sows – almost 6% [Ivanov 2014]. Over the same period, from 1991 to 2016, the number of pigs in Ukraine decreased from 19.5 million heads to 7.1 million. It is almost in 3 times from 14 million to 3.7 (without the Crimea and the ATO area) (about in 4 times) [Animal... 2016]. The collapse in prices for pork (about 11% in a month only in 2016) stimulates demand but not production [Ivanov 2014]. In 1990 Ukraine produced 1.6 million tons of pork but in 2010 it was only 0.63 million tons and in 2015 – 0.76 million tons. The share of agricultural enterprises in it has changed from 56.7% accordingly to 40.5 and 53.0%. In 2000 this proportion was only 13.5% [Animal... 2016]. All categories of producers in 2016 produce the 2.32 million tons of meat of all kinds in for slaughter weight, that corresponds a level 2015 years. Thus the production of pork and poultry raised on 0.1 and 2.4% accordingly, and the production of beef continued a tendency to falling which was 5.1% [Lebedeva 2017].

In 2015 pig raising in Ukraine has been decreased by 3.5% compared to 2014 and amounted to 7.08 million heads. In the households there was a significant reduction of livestock – by 6.6%. In 2015, the share of households was 51% [Mazurenko 2016]. On 1 August 2016 there were 7.55 million pigs in Ukraine. Among them 51% held by the industrial sector. In 2016, its share is higher than in 2015, and the number shows growth of 1.6% (61 thousand heads) [“Libra”... 2016]. In the sector of households pig raising reduction will be observed in the future. So reducing the number of pigs in the population (–6.1% or 238.4 thousand heads) resulted in 2.3% “lag” of the total number of animals in the country [“Libra”... 2016].

The price of pork in 2016, as well as expected, brought little gladness for producers. Through that replacement of the Russian market did not succeed to be found and the export practically zeroed, while a production remained at the level of previous year, at the Ukrainian market there was surplus suggestion of pork and price remained low. Producers and resellers with mediators a few times tried to lift prices in traditional periods of increase of demand, but sales were not justified by expectations. As a result, the wholesale price of pork grew for the year (from December 2016 to December 2015) of all on 6% in UAH and fallen down on 5% in a USD equivalent at that the world costs of pork as an index of FAO grew for a year on 18%! “It is ‘two’ for exporters even taking into account complications connected with ASF” [Pankratov 2017].

In the domestic pig raising there are three industrial sectors:

- new businesses with high efficiency;
- upgraded ones with an average efficiency;
- low efficient old farms.

Pig raising industry type capacity 54, 108 and 216 thousand pigs per year proved to be the most viable market conditions. Medium-sized pig raising industry with a complete production cycle capacity of 6, 12 and 24 thousand pigs per year is the most numerous. Small pig raising industry (1 000 to 3 000 pigs) after a year turned out to be unprofitable because of outdated technology, unbalanced nutrition and low genetic potential of the breed [Mazurenko 2016].

The number of medium and small producers is gradually reducing. They cut their production and leave the market. This is due to the structure of large vertically integrated companies specializing in growing pigs that are less prone to exchange rate fluctuations risks, some of them have their own retailing structure.

At the end of each year the Association of Pig Producers of Ukraine traditionally publishes top rating of pork producers. In 2015, the list of top five remained unchanged. The first step is fixed by the APK-Invest. It concentrated 7.4% of pigs. This sector accounts for almost 11% of live bait, realizing the slaughter farms. Today

the power of the APK-Invest allows to keep fattening up to 600 thousand pigs per year and occupies 11% of market share of chilled pork a year. In 2015, they produced 42 thousand tons of pork meat (7% over 2014), representing 22% of the market for industrial pork production [Rating... 2015]. Livestock breeding complex has a status of the Landrace breed reproduction.

In the second place there is a new “owner” of the PAP Agroprodservice. In April 2015, the total number of pigs in the corporation amounted to 115 thousand including 14 thousand of sows. They have received the status of Landrace breed reproduction. The average increase in pig fattening stage is 900 g with an average output of 6 062 kg of lean meat per 100 kg body weight, which are the best indicators in Ukraine [Rating... 2015].

The Danosha Ltd. has increased the breeding stock in 2015 with a 12.8% compared with 2014, so it takes the third place [Rating... 2015]. Production is based on Danish know-how and high-quality genetic material imported from Denmark.

The fourth place is given to the SPE Globinskiy pig farm LLC. It includes five companies: Globinskiy meat LLC, the Globinskiy Dairy Plant OJSC, the Globinskiy Granger Complex LLC, the Globinskiy pig farm LLC and the Globinskiy Raia-globud LLC. The company also has the status of pedigree breeding pigs of Landrace breed. There are more than 148 thousand pigs there [Rating... 2015].

Most big farms focused their attention to meat and bacon breeds, otherwise the rural households prefer meat-sebaceous pigs [Svynous and Podgorny 2014].

There are several major factors that badly affect the development of pig production. First, the increase in production costs. It is difficult to achieve the desired economic effect even with modern technologies. Thus, the feed conversion of about 3.0–3.2 kg per 1 kg increase in the cost of production is about 30 UAH/kg. We can only to achieve this level of conversion by feeding the animals with exclusively high protein feed, including soybean meal. This type of food is one of the most expensive on the market. Thus, the cost structure fodder component occupies about 65–70%. In addition, the total cost involves farmers wage growth, higher energy bills, veterinary medicines etc. [Maslak 2016]. Secondly, the competition in the market of meat and meat products has increased. Compared to 2013, in 2015 Ukrainian demand for pork has been fallen by 23–25%. Consumers prefer poultry meat rather than pork because poultry meat is much cheaper. According to the annual fund meat consumption 2.55 million tons consumption of meat per capita is accounted for 56.1 kg, and this volume share of pork meat 38%, poultry – 43%, beef – 17% (Fig. 1). For comparison, Ukrainian Ministry of Health recommended annual rate of meat consumption per capita is 80 kg. Therefore, the internal market is to increase consumption allowance [Maslak 2016].

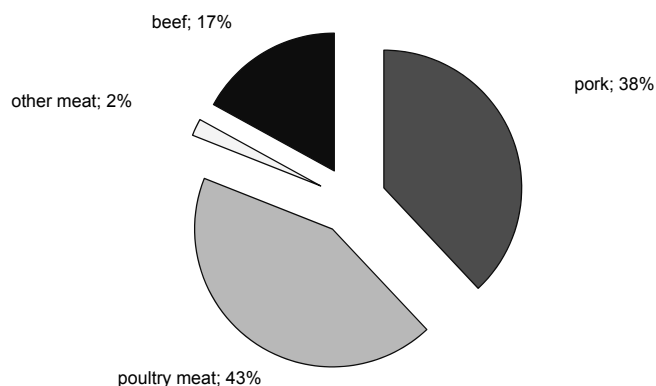


Figure 1. The structure of meat consumption in Ukraine in 2016
Source: own study based on SSSU data [Maslak 2016].

It should be noted that in 2015:

- special regime of VAT to farmers has been operated, and in 2016 it has been cancelled;
- return VAT prices for feed has started;
- domestic market has been decreased (Crimea, Eastern Ukraine);
- export to Russia has been stopped.

In 2016 a consumption by population of meat grew on 0.5 kg and was 51.4 kg on a man, but this index however falls behind from a rational norm on 36%. On results of 2016, the volume of consumption of pork and pork products was 827 thousand tons, that is on 6.7% more than in 2015. An actual increase of consumption of pork by average Ukrainian is 7%. Therefore in 2016 the ration of users was increased on 1.3 kg of pork. At the same time, poultry and beef were consumed less than in 2015 (on 6 and 2%, accordingly) [Lebedeva 2017].

The problem in Ukraine is the high cost of capital. If European farmers can take loan at 3–4%, the Ukrainian people take it at 2–25%. To get loan in Ukraine for agriculture, farmers must wait for 2 years, and to raise a farm will last for about 3–5 years. Rising costs for energy and water should also be taken into account [Ivanov 2014].

The pig production base is also unsatisfactory. According to the results of surveys slaughter points, much of it is adapted premises is almost 40%. More than a third of slaughterhouses not slaughtering lines, about 70% – treatment plants, 23% – water supply [Ibatullin and Artemonova 2015].

Important causes in a significant reduction in the number of pigs in the country should also include: disparity in the prices of agricultural and industrial products; rising prices for feed; inability of most domestic producers to apply new technologies and maintenance of fattening pigs; elimination of specialized pig farms; satu-

ration of the domestic market for foreign raw materials; reduction in government support. Today the structure offers significant share of domestic production covers foreign production volumes, that in a certain measure compensates the lack of pork at the internal market as a result of reduction of population of pigs in the country (Table 2). However, the quality of products imported into the territory of Ukraine is very low [Okhrimenko 2012].

Table 2. The foreign trade turnover of pork in Ukraine in 2011–2015

Pork fresh, chilled and frozen	2011		2012		2013		2014		2015	
	quantity									
	thousand tons	million USA	thousand tons	million USA	thousand tons	million USA	thousand tons	million USA	thousand tons	million USA
Export	12.5	57.6	20.2	92.6	4.62	20.9	9.4	26.3	27.2	54.7
Import	86.2	160.6	207.7	440.6	150.2	388.6	30.6	80.1	3.7	8.2

Source: own study based on SSSU data [Ukraine's... 2013, p. 50; Ukraine's... 2014, p. 53; Ukraine's... 2015, p. 50; Ukraine's... 2016, p. 53].

Thus, information in Table 2 shows, that for the last three years the volume of import of pork to Ukraine some extent reduced, that it is to a great extent related to large pig breeding enterprises of industrial type of full cycle functioning activation.

Nowadays, pork producers have accumulated considerable stocks of meat. Pork inventories increased 1.6 times, poultry meat inventories – 6 times. For 5 months of 2016 beef production increased by 1% (compared to the same period last year) (88 thousand tons). But exports fell by 2.4 times – from 22 thousand tons to 9 thousand tons. Imports has increased from 0.4 thousand tons to 0.7 thousand tons. In total, according to FAO, 5 months of 2016 stocks of meat in Ukraine amounted to almost 127 thousand tons (in slaughter weight) [Kolyubakin 2016].

Year 2015 was a turning point for the pig industry: almost left the market imports but strengthened domestic competition, the cost has increased, but dropped wholesale prices and purchasing power of the population, increased state support, but decreased availability of credit. In the pork market there were changes as well as redistribution of power. In 2014, the share of large companies in total pork production was 24.5%, in 2015 it increased to 26.8%. With the closure of the Russian market, Ukrainian traders have to face their neighboring Georgia (about 21%), as well as more distant but equally promising Hong Kong (20% of total exports) [Mazurenko 2016].

Exports of pork from Ukraine is characterized by specific problems:

- lack of modern deep processing;
- ignorance of the markets in which we want to go out;
- deficit of management skills, capital and confidence etc.

Regarding the latter in developed countries each case of abuse as the product is treated as a violation of human causes a reaction, even if it does not come to trial, the company loses its reputation.

The European market, due to lack of official permits for export manufacturers, the high price of Ukrainian, remains closed to the domestic pork production. In addition, experts say that we need 2–3 years to change approaches and modernization of production in general. Therefore, stabilization of exports can be expected not earlier than in 2018 [Mazurenko 2016].

The main possible direction is the reorientation of exports from the North (Europe) to the South. But there are some nuances, like lack of quality, deep processing of high value-added. We must also take into account the needs of specific markets. Residents of the East and Africa like to have meat products and it is not a matter of habit, but also protection against numerous intestinal infections. However, priorities are export markets of the EU, since Ukraine gained duty-free quota for the supply of 40 thousand tons of pork. For comparison: in 2014 Ukraine exported only 4 thousand tons, which is extremely small amount [Maslak 215].

Exports of pork in May 2016 have not scored significantly. Thus, the total external deliveries of fresh, chilled and frozen pork (0203 UKT ZED) in January – May “crossed” the mark of 1 thousand tons and even exceeded this level, but the products of foreign origin received actively and in large quantities. As a result of 5 months of the year on the domestic market supplied 1.91 thousand tons of pork from abroad a total value of 2.69 million USD. This is 1 million USD exceeded the total cost of pork exported from Ukraine, so ended the period with a corresponding negative balance of foreign trade in pork [Trade... 2016].

The volume of exports of pork decreased by almost half in comparison with the April and amounted to 93.4 tons. As a result, overall shipments of pork abroad for 5 months of 2016 comparable with the first export of this type of meat as in January or August last year, in the month, when traders were the least active. The number of exporters in the month dropped to two, but each of them has extended the geography of new trade channels. Thus, pork legs “went” to Vietnam and Hong Kong, and frozen pork to neighboring Georgia and Armenia. While trimming imports, which is traditionally fed mainly from Poland and Germany in May was 40% lower than in April, Foreign Trade balance in this commodity group is not saved. Frozen pork, mostly legs, in slightly smaller quantities (355.5 tons) than in

April, were sent to Hong Kong (29%) and Vietnam (71%). Meanwhile, three more volumes of such products Ukraine bought from the EU (frozen liver – 1.2 thousand tons and lard – 3.15 thousand tons) [Trade... 2016]. The main providers of pork to Ukraine are consistently Germany (47% of all imported products), Poland (20%) and the Netherlands (18%).

New suppliers of products to the Ukrainian market were Denmark, Austria, France, Sweden, Finland. In preparation for free trade zone Ukraine allowed the importation of beef and pork from Canada without additional certification that will give Canadians 50 million annually [Mazurenko 2016].

For Dodger experts in the coming years for the domestic pig priority to the domestic market foreign markets will be possible after the withdrawal improve the quality of domestic products [Mazurenko 2016]. There is a slightly different point of view on what we expect for the domestic market. People will not buy because they do not have discounted prices. Europe is willing to supply pork to us. It could finally finish off the domestic producers, which has the lowest level and thus the profitability of the history of independent Ukraine. And we can not interfere as we are so committed to the EU [Kolyubakin 2016].

One way out of this stalemate is already visible: in developed countries, there is a program of food aid to low-income school lunch that provides procurement and manufacturer. It is an effective support for farmers during the market crisis. Low purchasing power does not matter the industry, it goes far beyond concerns and general economic policy of the country (or its absence, although the lack of a policy).

Falling prices for meat encourages manufacturers to reduce costs, but it can save the expense of quality during the very short term. It will result in lasting damage due to loss of reputation. This will not work and we are under the risk of being left with no livestock at all [Ivanov 2014]. It is important for the development of the internal market of meat and meat products to increase the exports and reduce the imports. In this area there are positive developments. Import of pork in 2015 will decrease by almost half (January – March, Ukraine imported 779 tons, compared to last year's figure of 13 thousand tons) [Maslak 2015].

Experts believe that the long-term potential of the industry is 60 million heads (short-term forecast – up to 30 million heads) [Ivanov 2014]. Thus, given the restrictions on imports of pork, expanding external sales channels pig industry is promising for Ukraine [Maslak 2015].

An important factor in the formation of modern pork market in Ukraine and in Europe as a whole is a virus of African swine fever (ASF). In 2015, Ukraine has a record in the time of ASF spread – 40 cases per year [Mazurenko 2016]. In 2016 Ukraine has eliminated more than 80 thousand pigs. By the end of the year predicted

outbreak of ASF is in the 35–79 settlements. Currently, it is fixed at 10, mostly border areas, mainly – the northern and eastern. If this trend continues, the country will have at least 22 million direct losses and indirect losses 7 million [Yasynchuk 2016] – nearly 1.1 million USD. And if we take into account the costs of lost opportunities because of the epidemic the import of has banned pork and feed for pigs on the territory of the State Service for Food Safety of the Ministry of Agriculture of Armenia [Losses... 2016].

Belarus has a similar situation nowadays. From the projects concerned the expansion of production capacity of medium-sized companies refused pork producers. Among the reasons for the rapid spread of ASF in the country is a sabotage of the countries aggressor [Yasynchuk 2016]. In addition, Dodger on the spread of the disease was calculated mathematically last year. The last few years the virus is circulating in the Caucasus, and then it hit the south of Russia. In August, 64 were found in pockets of ASF since the beginning of the year – more than 182 in Lithuania – 60, Poland – 18. A straight white map – Belarus, although it is known that ASF is there.

The problem is that in Ukraine there is no insurance against illness ASF, however, as a mechanism for compensating large producers. And if the infected herd is found in any locality it must be destroyed even all livestock within a radius of 20 km from the epicenter of the epidemic. In Ukraine, a taboo to check pig raising farms has been made for 2 years. That is why the doctor state veterinary service has no right to come to the company and check its stock if they do not ask the owner. Veterinarians are not prescribed certificates for products, so no one is watching the quality. In Ukraine, the spread of the disease contributes to the human factor as well. Amount of 3.5 million pigs have grown in farms especially in the western regions. Households in this regard are absolutely uncontrollable. ASF also affects small farms where pigs 500–600 held and where a low level of safety. People have no confidence in the state to pay them compensation for the destroyed cattle because pigs are hiding existing products and implement practically underground.

CONCLUSIONS

Reform changes that were made in the agricultural sector had a negative impact on the pig raising industry. Country lost the leading position among the world's pork producers. Instead of competition between producers of pork came competition between the large integrated companies for maintaining their dominant positions on the market – wholesale, processing, sales organization, distribution of goods etc. The largest producers of pork in Ukraine are agricultural holdings, which include most powerful stock with its own resource base and efficient trade network. The most

rational way to remedy the situation is further development and increased concentration of production by creating conditions for the development of integration processes in the pig raising industry involving government subsidies to the industry.

The internal market of pork in Ukraine for today is not obviously saturated, as a result of reduction of industry of the pig breeding so of diminishing of import, however growth of this saturation and level of consumption of pork by populations here is braked in a considerable measure by price factors at presence of low level of profits of population. The external market for Ukrainian pork now is also limited, as Europe produces this products in sufficiency, thus – of high quality.

Expansions of the external channels of sale of pork and limitation of its import do industry of the pig breeding perspective for Ukraine. However, during the nearest years priority for the domestic pig breeding will be an internal market. To the external markets an output will be possible after upgrading domestic products quality. An important area of pork market improvement in Ukraine is the development and modernization of the processing industry, including slaughter points and local points of the primary processing and also power for raw materials and finished products storage.

The priority of conceptual problems to be solved in the near future in order to revive the domestic industry and increase production of high quality pork should include conservation breeding base of the domestic pig and financial interest in breeding grow of high-quality young stock, taking into account modern methods of its assessment of the phenotype and genotype for repair mass pig production to improve product performance of different categories. Farms should establish forage processing to produce high-grade animal feed using vitamins, minerals and biological mixtures; creating favourable conditions for bank capital in the agricultural sector, and develop a mechanism for their implementation; instead of 250–350 g average daily growth to bring it to 600–800 g. Pork with this performance will always be cost-effective and high quality. This can be achieved only by full feeding animals of all ages, create their optimal conditions of detention and the use of advanced breeding and genetic methods in breeding work at pure breeding, crossbreeding and hybridization pigs. It should always be kept in mind that the provision of public domestic pork production is the most important task of the country, and its imports are wasted and not always safe in both qualitative and quantitative terms.

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THE EVOLUTION OF THE U.S. SWINE INDUSTRY

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Abstract. The paper presents the development of the pig industry in the USA. To present a problem, information on production, exports, and the size of the herd. The article uses data from the U.S. Department of Agriculture, Economic Research Service Services. The survey proved the development of swine industry in recent years. The research showed that U.S. pork industry is dramatically different than it was 30 years ago. The pork market is characterized by multiproduct farms and integrated industry, where the large packing plants work with integrators to produce uniform animals on a reliable schedule. The price per pound for the consumer is much less and U.S. pork exports have grown rapidly.

Key words: production, trade, pork, USA

INTRODUCTION

The swine industry in the USA has changed greatly over the last 40 years. The number of swine farms has decreased steadily, while the hogs per farm have grown dramatically. Historically pig production was a complementary activity for crop farmers, especially producers of corn and soybeans in the Upper Midwest, the so-called Corn Belt. The crop farmers would have a few sows and feed the baby pigs to market weight, creating substantial value added for their crop production and giving them a productive use of their time during the winter months. A substantial share of the pork production came from this joint production. Over time it became clear that the opportunities for greater coordination between the farmers and the processing plants could generate considerable cost savings. Using the example of the poultry industry where the processing plants made contracts with poultry farms, and the industry made dramatic productivity increases in plant efficiency because the chickens arrived at the factory in a predictable manner and furthermore, the genetics of the poultry being produced advanced quickly creating greater feed efficiency, higher meat quality and uniformity. Vertical integration, where the processor contracted

with the farmers and controlled the entire production process, became common in the early 1950s. Now virtually all of the U.S. chicken production is integrated and most turkey production as well.

THE PURPOSE AND METHODOLOGY OF RESEARCH

The aim of the study was the evaluation of the swine industry in the USA. To develop the main goal following specific goals have been elaborated:

- the evolution of pig production in the USA;
- the analysis of pork exports in the USA.

The author used trend, tabular, graphical, descriptive methods and the elements of cause – effect analysis to find the reasons for the observed occurrences. The time was 1997–2012. The author used data from U.S. Census of Agriculture.

RESEARCH RESULTS

As may be seen in Figure 1, the pork production is still predominantly in the Corn Belt (the states where most of the corn and soybeans are produced). However, with the move to integrated pork production, many hog operations moved to North Caro-

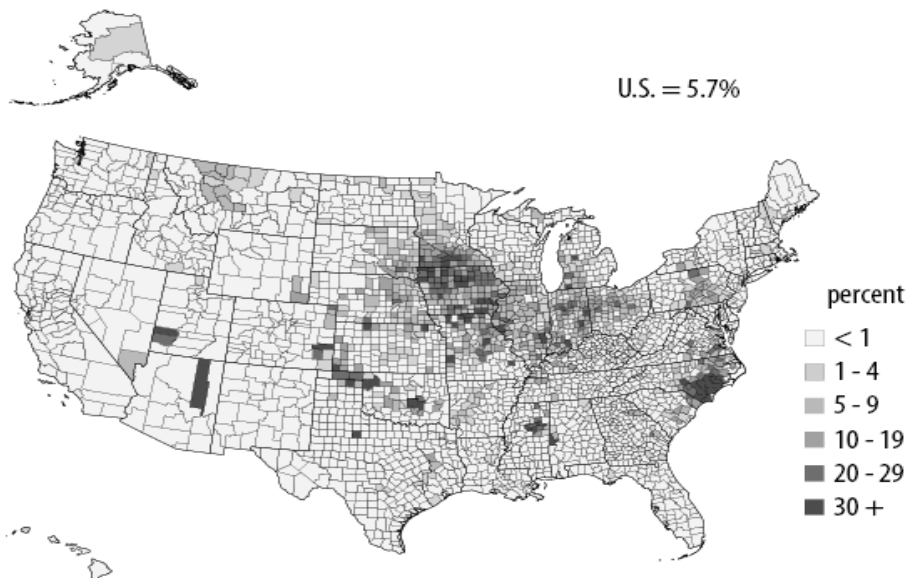


Figure 1. Hog and pig sales by county in 2012
Source: USDA NASS, 2012 Census of Agriculture.

lina, also the home to substantial contract chicken production. Because farmers in this region have a history of contract animal production, it was easier to establish contracted integrated pork production in this region than in the Corn Belt. Agricultural lenders had made loans for contract animal production for many years, while in the Corn Belt contract agriculture was new to the lenders. Unfortunately coastal Carolina has hurricanes and this had led to the death of millions of hogs on at least two occasions as well as the overflow of the sewage lagoons, spreading manure into streams and rivers and creating considerable pollution.

As the swine industry found it was losing market share to chicken in the meat market because of the genetic, nutritional, and management advances in chicken, and to a lesser extent, turkeys, the pork processors moved to integrate with the farmers as well. Led by the larger processors, grower contracts became increasingly common and the improvements in swine genetics and nutrition led to steady improvements in feed efficiency and time for the hogs to reach market weight. Also the increased uniformity of animals improved labor productivity in the processing plants and allowed greater mechanization. The net effect is a steady increase in the size of the average swine herd and an accompanying decrease in the number of operations. Table 1 illustrates this change. In 1977 there were 477 thousand farms producing hogs, averaging 110 animals per farm and by 2012 there were 63 thousand farms averaging over 1 thousand animals per farm. The newer operations are considerably larger and as the older become out dated, they are replaced by much larger buildings and herds.

Table 1. Hog operations in the USA over time

Year	Production	Operations	Average herd size
1977	52 271 120	477 115	110
1982	55 366 205	329 833	168
1987	57 563 118	243 398	236
1992	57 698 318	191 347	302
1997	60 405 103	124 883	484
2002	61 188 149	78 898	776
2007	67 786 318	75 442	899
2012	66 026 785	63 246	1 044

Source: U.S. Census of Agriculture [various years].

The implications of these changes have been frequently studied by scientists, such as: Dirks and Fienup [1965], Barkema and Cook [1993], Hurt [1994], Rhodes [1995], Hayenga [1996], Benjamin [1997], Kliebenstein and Lawrence [1997], and Reimer [2005]. The changes have dramatically increased the market power of the processors, especially as mergers and takeovers have increased the concentration in

the industry. The small pork producer has less bargaining power given the considerable spatial monopolies of the large processors, which would be significant even without the vertical integration. Sometimes the integrator is a separate entity from the processor, although the integrator is often owned by the same families as the processor. A former student of mine used to be a feed buyer for one of the integrators and I asked him how many hogs he fed per year. The answer was 1 million! This group produces more many hogs per year now than it did when I asked the question.

The improvements in genetics, management, feed efficiency, pigs weaned per litter, and other measurements of performance each year are astonishing. The average pigs per breeding sow was 19.8 in 2013, up from 18.7 in 2008 [NASS 2015]. In 2014, 93% of the pig crop was from herds of more than 5 thousand head [NASS 2015]. The breeding herd was only 9% of the pig inventory in 2014 [NASS 2015]. These figures bear little resemblance to the same performance measures a decade earlier. Unambiguously, whatever the measure used, the industry is vastly more efficient and more environmentally benign than 20 years prior.

Pork prices 30 years ago were much higher than they are now. It was quite profitable to raise hogs on a small scale before 1990. At that time, the increasing integration increased the supply of hogs, putting considerable pressure on the smaller producers. By the mid-1990s, most small pork producers were no longer economically viable and the move to large integrated producers was largely complete. These integrated producers often hired the farmers that previously owned the production buildings to raise the animals under contract and if prices fell, the farmers were not as vulnerable because the price risk was borne by the integrator. The integrator had the advantages of considerable economies of scale, especially in purchasing, and had the further advantage of sharing the proceeds from the sale of the retail pork products. Furthermore, the larger scale of production often meant that they spread their production over a longer period and so were not as exposed to short-run price decreases as the smaller producers were who often sold all of their animals at one time.

The integrators actively improve their genetics, since they have so many animals and so the genetic quality of the hogs has risen sharply. Furthermore the integrators work with the swine scientists to improve feed efficiency and growth rates. Chris Hostetler [2014] in an article for the pork Checkoff showed feed efficiency has improved steadily in recent years. One of the most important implications of improving feed efficiency is that pork can now keep up with the genetic advances in chicken, and to a lesser extent turkeys. Consumption of beef, chicken, and pork, shows the degree to which chicken, with its vertical integration, genetic advances, and improved feed efficiency, has become the leader in meat consumption at the expense of beef.

While pork's has not grown, neither has it shrunk. Much of the reason is because the improvements in the cost of production with vertical integration and rapid adoption of better practices have kept hog production costs and feed efficiency competitive with the growth in chicken consumption. Meanwhile, beef still requires about 2.5 lbs of grain per pound of weight after gaining its first 700 lbs of weight from grazing. Since a steer is a much bigger animal, this means that it is more expensive to produce a pound of beef, and beef requires a higher price per pound of meat for the producer to break even.

Today's pigs are leaner than in the past and more muscular. The method of grading pigs by leanness and muscling was adopted as production practices and breeding made the modern hog a very different animal than it was in the past [Prichard 2013]. Dietary guidelines discourage eating fatty food and consumers have responded to the change by demanding a very different hog than was produced in the 1950s. The pigs mature faster and taste different than before. Vegetable fat is now used for cooking rather than animal fat that was common in the past. Animal scientists at agricultural universities have advanced the knowledge of improved feeding practices and diet for swine. Such educational web sites as Crenshaw's site at Mississippi State University are examples of disseminating research findings to hog producers.

The interesting thing is that despite the production of leaner hogs, a current food trend is to have bacon as an ingredient of many dishes. The contrast between the talk of consumers who say they want leaner pork and healthier meals and the fad of having widespread use of bacon in meals is similar to other talk and behavior inconsistencies. People say they are worried about salt in their diet and then often eat salty snacks.

Although one could easily conclude that vertical integration represents the majority of U.S. swine production, in fact there are small and medium sized hog producers still operating. Pennsylvania State University has a publication for small swine operations [Linneen et al. 2016]. This guide says that only 1% of the swine producers produce more than 1 thousand heads per year. Some buyers are particularly interested in the traditional fatter hogs, such as the Amish, a conservative religious group in Pennsylvania and other states. While the mainstream producers are focusing on the retail market, these niche markets still exist and can be quite lucrative for those managing to serve them.

The ten largest packing companies are very important and represent 89% of slaughter in 2012, with Smithfield alone having a 26% share (CME Group). Most of these packers are highly integrated and slaughter mainly their own contracted animals.

PORK EXPORTS

The improved efficiency of pork production has made U.S. pork much more competitive on world markets. This has led to an enormous increase in pork exports. As seen in Figure 2, pork exports have grown steadily from 1989 until 2015, and now are twenty times their value in the first year.

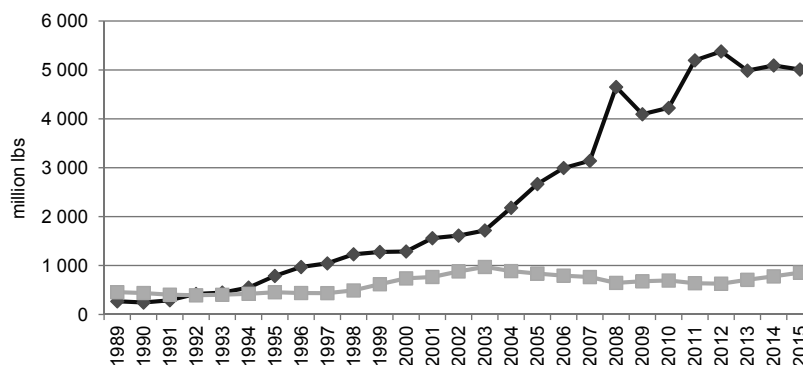


Figure 2. U.S. pork exports and imports in 1989–2015
Source: USDA, Economic Research Service [2017].

The biggest customers are Mexico, Japan, Canada, South Korea, and China. While these countries, other than China, have always been major pork buyers from the USA, the list of destinations has grown as U.S. pork prices have been more in line with world prices.

This is unambiguously the result of the integration of the industry, with the accompanying decreases in the cost of pork production. In 1989, U.S. pork imports were several times larger than exports, but the opposite is now true, as exports are more than four times the pork imports.

CONCLUDING COMMENTS

The U.S. pork industry is dramatically different than it was 30 years ago. What was once an industry characterized by small herds on multiproduct farms is now an integrated industry, where the large packing plants work with integrators to produce uniform animals on a reliable schedule, where the meat is leaner, uses less feed per pound to produce, and the animals are raised in much larger, single-purpose facilities (Fig. 3). The price per pound for the consumer is much less and the small farmers are

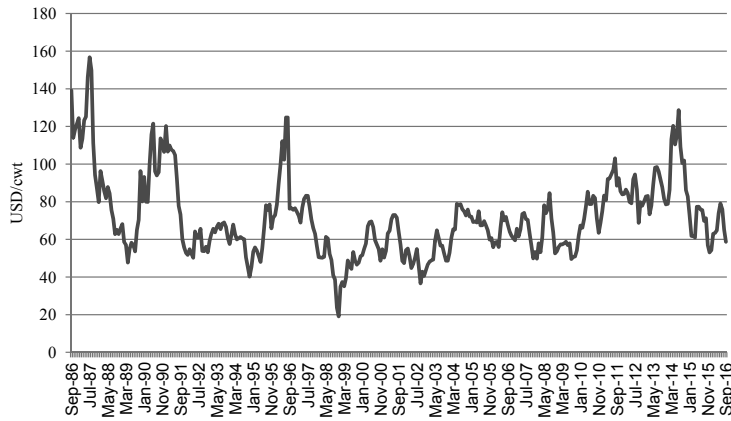


Figure 3. U.S. hog prices in 1986–2016
 Source: USDA, Economic Research Service [2016].

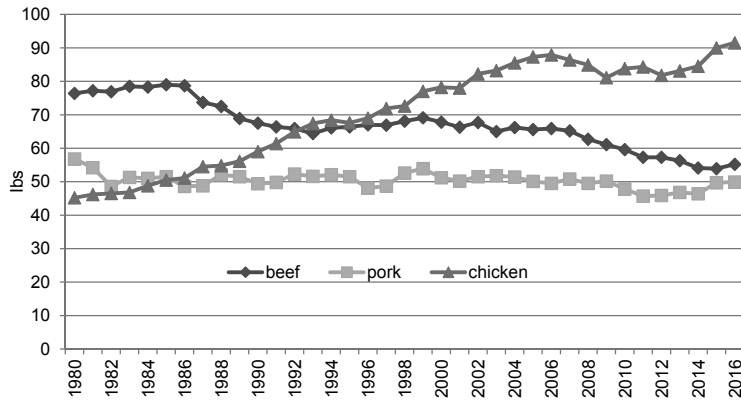


Figure 4. Per capita meat consumption in 1980–2016
 Source: USDA, Economic Research Service [2016].

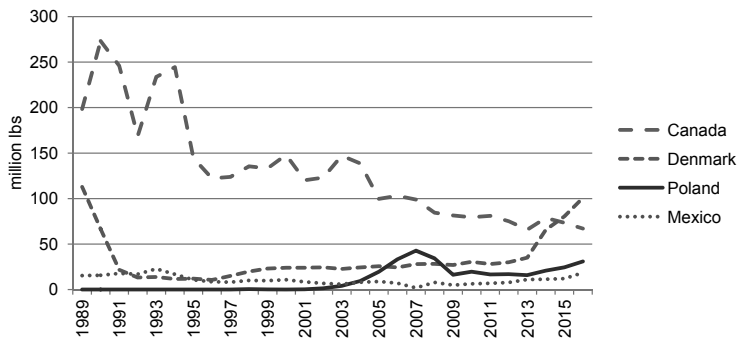


Figure 5. US pork imports in 1989–2016
 Source: USDA, Economic Research Service [2017].

largely out of the industry. While beef consumption has been steadily declining, per capita pork consumption has been stable (Fig. 4). The U.S. pork exports have grown rapidly, as U.S. pork is more competitively priced on world markets. Import of pork to the USA is decreasing. The U.S. import pork mainly from Canada, Denmark, Poland and Mexico (Fig. 5).

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LEGAL AND ORGANIZATIONAL ASPECTS OF THE TRANSPORT OF PIGS IN POLAND AND SELECTED EU COUNTRIES

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Abstract. Transport of livestock is a necessity, especially in case of animals for slaughter and breeding. In the European Union the transport covers over 365 million livestock (poultry excluded), including 225 million of pigs. In the European Union and in Poland, about 70–80% of transport make animals for slaughter. The most challenging is long-distance transport, which concerns 60 million animals a year. The transport causes severe stress, fatigue and puts the animals at risk of injuries and illnesses. The number of transported animals makes it necessary to establish and enforce legal regulations of regarding this area of activity. The European Commission continuously works on improving the current regulations on animal welfare during transport and on their compatibility in different EU countries. The main aim of the article was to present the crucial legal and organizational aspects of the pig transport and to identify infringements occurring during pig road transport in Poland. Main problems detected during inspections concerned the proper documentation, construction and technical condition of lorries and poor pigs fitness for transport. Another important deficiencies concerned exceeding time of transport. However, results show, that the total number of infringements decreased from 1 082 in 2008 to 209 in 2015. Important improvement was observed from animal welfare point of view, because density of transported animals was improved as well as construction of means of transport, which assure better conditions and safety.

Key words: law, pigs, transport, animal welfare, infringements

INTRODUCTION

Transport of livestock is a necessity, especially in case of animals for slaughter and breeding. Unfortunately it causes severe stress, fatigue and puts the animals at risk of injuries and illnesses. In the European Union the transport covers over 365 million

livestock (poultry excluded), including 225 million of pigs¹. Some of freight transports are short-lasting, i.e. their duration does not exceed 8 hours. The other group are the long-lasting freight transports, often taking several days. Eurostat data show that annual long-distance transports concern 60 million animals, including 30 million pigs. Both in the European Union and in Poland, about 70–80% of transport concerns animals for slaughter. Compared to the duration of the production cycle of livestock, transport is short, however, it may have adverse financial consequences for both the producer and the transporter. Economic losses may result from poorly organized or excessively long transport, during which the welfare of animals is greatly reduced. Pigs are very sensitive to the conditions of transport. They can suffer from heating stress, low temperature stress, dehydration, fatal collapses and many different injuries. Transporters can minimize all the risks by proper route planning, travel organization and complying with the EU livestock transport law.

DATA AND METHODS

The main aim of the article is to present the crucial legal and organizational aspects of the pig transport in Poland and selected EU countries. The other goal was to identify infringements occurring during pig road transport and define the opportunities to reduce the risk of negligence. The data covered years 2009–2015 and came from international scientific literature, EU annual reports on the protection of animals during transport, Eurostat, Polish Statistical Yearbook.

PIG PRODUCTION IN THE SELECTED EU COUNTRIES

Pigs are very sensitive to the conditions of transport, still, because of the situation on the live pig market, transport of this animal species keeps increasing. For several years Polish producers of pigs have been forced to import piglets from the countries of Western Europe. This results from the unfavorable structure of the domestic pig population and a large fragmentation of production.

In overall, the size of the pig population in the European Union is growing. In 2015 there was reported an increase in the number of pigs in the EU by 1.8%, which was due to a significant increase in the pig population in several countries: Spain (+6.2%), the Netherlands (+2.8%) and France (+2.3%). At the same time

¹ The data refer to 15 EU members before the accession of the new members in 2004 (i.e. to Austria, Belgium, Denmark, Finland, France, Greece, Spain, the Netherlands, Ireland, Luxembourg, Germany, Portugal, Sweden, and the United Kingdom). These countries are referred to as the Old Union.

a decreasing trend in the size of the population were observed in Austria (−1.5%), Belgium (−1.4%), Ireland (−1.2%) and Poland (−0.7%). Figure 1 shows the geographical distribution of pig production in the European Union. Countries excelling in pig production are Germany, Spain, France, Denmark.

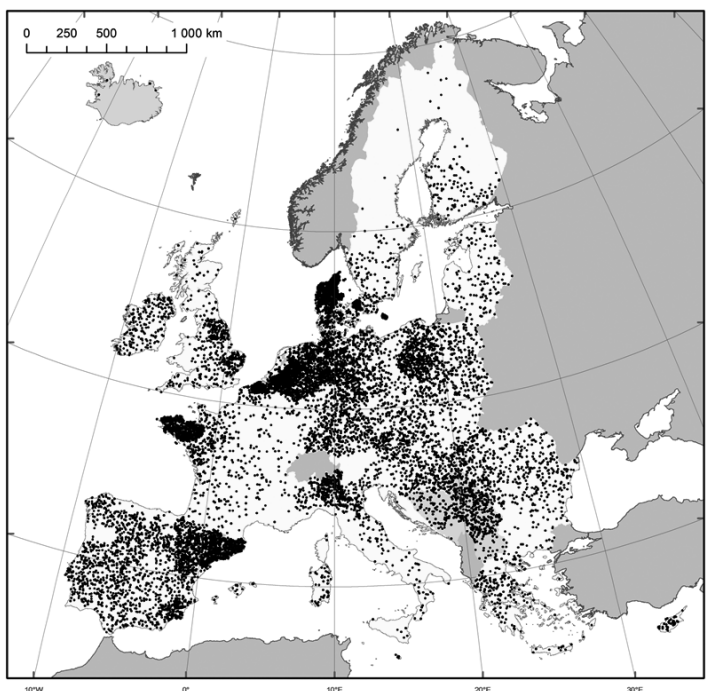


Figure 1. Pig production in Europe in 2013

Source: [http://ec.europa.eu/eurostat/statistics-explained/index.php/File: Number_of_cows_by_region_\(2013\).png](http://ec.europa.eu/eurostat/statistics-explained/index.php/File: Number_of_cows_by_region_(2013).png)

According to the data from the Central Statistical Office (pol.: GUS), the pig population in Poland is decreasing. In June 2015 it fell down to 11.6 million and was 84.3 units less than in June 2014. The number of sows has also decreased compared to June 2014 by 61.8 units (−6.1%) to the level of 947.0 units, including gestating sows by 49.0 units, i.e. by 7.1%, to 640.4 units. A decreasing interest in this farming activity is due to its low profitability as a consequence of a wide dispersion of production. In Poland, an average herd numbers about 50 pigs, and productivity fluctuates between 16 and 18 fattening pigs from one sow per year. These factors are not conducive for Polish farms to compete with the farms operating on a large scale in such countries as Germany or Denmark where farms are very well managed and very large, with an average stocking density ranging from around 1 thousand (Germany) to around 2 thousand (Denmark).

FOREIGN TRADE IN LIVE PIGS IN THE SELECTED EU COUNTRIES

According to the Ministry of Agriculture and Rural Development it has been several years since Poland is a net importer of live pigs. Data from the January – February period from the years 2011–2015 indicate a growing negative balance of trade in live pigs. According to the Central Statistical Office of Poland, up to June 2015 the import of pigs to Poland amounted to 1 926.1 units and was higher than in the same period of 2014 by 11.1%, and the average live weight of one imported unit was 29.4 kg. Most pigs were imported from Denmark, Germany and the Netherlands that developed the production of piglets, whereas fattening and processing is mostly carried out on the territory of other countries, which requires transportation of piglets for fattening often over considerable distances. The main recipients of Danish pigs are Germany and Poland (Fig. 2). In the first 10 months of 2015 the exports of live pigs from Denmark reached 10.2 million units, meaning approximately 800 units more than in the same period of 2014. In terms of the structure of imports, the major supplier of livestock are Germany with 30% share in the volume of imports. Considering the structure of the import value, it is dominated by Denmark with 40% share. Almost half of the pig number imported to Poland (46%) in 2015 were animals weighing over 50 kg, while piglets and weaners in weight to 50 kg accounted for 44%.

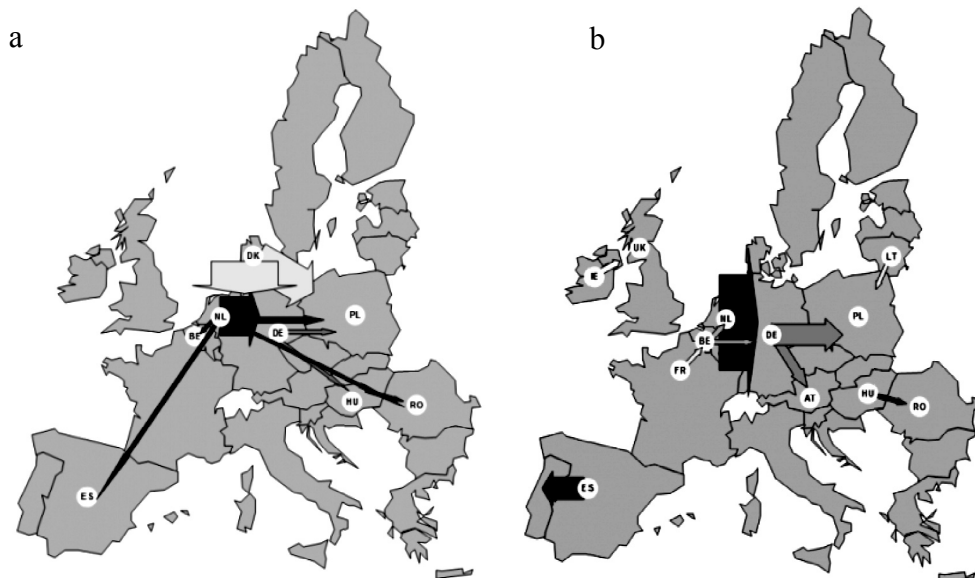


Figure 2. Net flow of live pigs from the EU in 2013: a – young pigs; b – pigs for slaughter
Source: Pig farming sector – statistical portrait 2014. Retrieved from: http://ec.europa.eu/eurostat/statistics-explained/index.php/Pig_farming_sector_-_statistical_portrait_2014 (Access: 16.10.2016).

The transport of piglets for fattening will probably continue because Polish conditions do not allow for the development of farms producing pigs. The financial support applies only to small farms with up to 100 sows, giving a weekly production of piglets of 50 units. Owners of large fattening houses are not interested in cooperating with various piglet suppliers and in settling farms with piglets from multiple sources, mainly for epizootic reasons. The market seeks large batches of piglets, numbering at least 250 units, also because of easier organization of transport to meat plants (one shipment). Danish, German and Dutch farms are able to meet the demands of fattening units. In Polish conditions, to eliminate the transport of piglets from abroad would require restocking of sows and an increase of approximately 220 thousand units. Given a low profitability of the production of piglets, only large and very large farm, the size of a minimum of 400 sows (optimally 750 sows), are capable of competing with producers e.g. from Denmark.

For many years the dominant directions of the export of live pigs from Denmark are Germany and Poland (Fig. 2). The years 2013–2014 were characterized by large exports of live animals. In 2013 Germany received about 3.4 million units of weaners and fattening pigs for slaughter. The export of live pigs to Poland also hit a record level. In the first six months of 2013 exports of weaners and fattening pigs from Denmark to Poland increased by as much as 47% to over 1.33 million units. The number of 884.5 thousand livestock was imported from Germany. The interest in foreign piglets and weaners is high despite high prices of livestock. One of the reasons is higher weight of the livestock during the purchase, which guarantees to some extent easier fattening. An average weight of imported pigs was 45 kg and the average price was 80 EUR/unit net.

In 2015 exports of live pigs from Denmark to Germany decreased. There were exported 6.89 million units of weaners, about 2% less than in 2014. Similar export was from the Netherlands to Germany of around 3 million units (about 48% less than in 2014). Total exports from the Netherlands was lower by 38% and amounted to 5.48 million units. The limit on the transport of piglets and weaners was the result of the introduction from 1 April 2015 of the Regulations requiring accurate labelling of meat products, known as the COOL system (Country of Origin Labelling). The label must indicate where the animal was reared and where it was slaughtered. The rules favor domestic products because the full labelling gives consumers possibility to make an informed decision and choice of the product.

To Poland there were also brought about 2% less live pigs, that is 5.45 million units. The number of fattening pigs imported from Germany was less than half (approx. 340 thousand units) whereas the increase in the import of piglets and weaners

from Denmark hit 12% and amounted to 3.8 million units [Sutherland et al. 2014]. The data of import and export of live pigs in the years 2014–2015 from selected countries are shown in Table 1.

Table 1. The import and export of live pigs in selected EU countries in the period 2014–2015

Country	Number of animals in year (thousand heads)		Change (%)
	2014	2015	
Import			
Germany	15 083	14 064	–7
Poland	5 559	5 447	–2
Italy	1 065	1 448	36
Portugal	1 439	1 438	–0.1
Export			
Denmark	11 859	12 677	7
Netherlands	8 797	5 475	–38
Germany	3 630	3 064	–16
Spain	1 585	1 573	–1

Source: own work on a base of: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=agr_r_animal&lang=en (Access: 07.09.2016).

As indicated by the data presented in Table 1, apart from Poland and Germany significant importers of pigs are also Italy and Portugal, while the largest exporters are Denmark, the Netherlands, Germany and Spain. At the beginning of 2016 the transport of pigs began to rise again. From January to the end of June 2016 Denmark exported a total of 6.75 million live pigs, mostly piglets, it was 635 units (10.4%). During this time there was recorded the increase in the exports of sows for slaughter by 16.4% to 26 240 units, and decreased the export of live pigs by 20.8% to 131 113 units [Ministerstwo... 2016].

The data show the volume of international transport when the pigs are transported over long distances and transport often takes more than 8 hours. The other part of the transport is national transport over short distances. In the case of pigs, it covers mainly the transport of fattening pigs to the slaughterhouses. Table 2 shows the data on the number of slaughtered pigs in the EU in years 2013–2015.

The leaders in pigs slaughtering are Germany and Spain. In 2015, over 59 292 thousand pigs were transported from farms to slaughterhouses in Germany, while over 46 380 thousand pigs were transported for slaughtering in Spain. In France 23 280 thousand and in Poland 21 243 thousand pigs were transported in the same year. The number of transported pigs in all the presented countries increased from 245 808 thousand in 2013 to 253 286 thousand in 2015.

Table 2. Number of slaughtered pigs in years 2013–2015 in the selected EU countries

Specification	Number of animals in year (thousand heads)		
	2015	2014	2013
Austria	5 414	5 404	5 417
Belgium	11 887	11 855	11 915
Bulgaria	919	817	797
Croatia	1 089	977	1 103
Cyprus	577	564	609
Czech Republic	2 508	2 640	2 652
Denmark	18 717	18 858	19 108
Estonia	533	511	435
Finland	2 080	2 055	2 145
France	23 680	23 655	23 747
Germany	59 292	58 735	58 628
UK	10 848	10 466	10 299
Greece	1 505	1 597	1 678
Hungary	4 459	4 078	3 750
Ireland	3 225	3 043	2 904
Italy	11 304	10 931	13 099
Latvia	369	360	344
Lithuania	837	853	858
Luxembourg	158	158	148
Malta	62	70	71
Netherlands	15 418	14 596	14 014
Poland	21 243	20 504	19 120
Portugal	5 638	5 372	5 178
Slovakia	331	369	370
Slovenia	238	239	239
Spain	46 380	43 489	41 414
Sweden	2 560	2 562	3 753
Together	25 3286	246 772	24 5808

Source: own work on a base of: http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=agr_r_animal&lang=en (Access: 07.09.2016).

In the EU, there are attempts at reducing the time of transport of animals for slaughter to 8 hours by such means as promoting the development of local slaughterhouses helping avoid long-lasting transport of animals for slaughter. During prolonged, long-distance transports livestock get more tired and stressed, their welfare is disturbed for longer. Long-lasting transports also generate additional costs for which it is the consumers who have to pay. Members of the European Parliament resolved in one resolution that in addition to shortened time of transport, it is also important that the transport vehicles have appropriate equipment and the livestock is properly treated. To prevent problems with maintaining the welfare of livestock during trans-

port, the existing law – the same in all EU countries must be implemented in an effective and uniform way. European parliamentarians suggest increasing the number of inspections and applying stricter and more harmonized penalties for breaking the rules binding the livestock transport.

LEGAL ASPECTS OF THE TRANSPORT OF PIGS

In Poland, the transport of animals is regulated by the Council Regulation (EC) 1/2005 of 22 December 2004 on the protection of animals during transport and related operations and amending Directives 64/432/EEC and 93/119/EC and the Regulation (EC) 1255/97. The regulation does not apply to the transport of animals for non-commercial purposes, such as treatment, e.g. to a veterinary clinic. Non-commercial transport means the transport of animals carried out by farmers or breeders who transport livestock by themselves, e.g. for seasonal grazing or transport them not more than 50 km using for this purpose their own vehicles. These transports are not subject to regulations [Dobrzański et al. 2012]. They must meet only general conditions of welfare, such as animal safety, protection from adverse weather conditions, loading and unloading without causing animal injury, adequate space and height of the vehicle. Additional requirements concern the vehicle cleanliness and its disinfection [Instrukcja Głównego Lekarza Weterynarii GIW z. 420/AW-62/11].

Council Regulation (EC) 1/2005 applies to the commercial transport of livestock. Of commercial nature is the transport to slaughterhouses, as well as to buying stations, gathering places and the like. Then, the transporter must have a permit while the drivers and possible escorts their appropriate licenses. These guidelines apply to the animal transport exceeding 50 km.

Commercial transport may be carried out only by qualified personnel: a permit in case of the transport (for up to 8 or above 8 hours), driver's/escort's license (after completed training). Licenses for transport are issued by a District Veterinary Officer after training culminating in an examination. Licenses are granted for an indefinite period [Cierach and Idaszewska 2014]. In the case of transport of not more than 8 hours there must be a certificate of approval of the means of transport. The vehicle must be clearly marked so that it is obvious that it is carrying live animals. Related legislation also provides the requirements regarding the construction of vehicles, separate for the vehicles used to transport animals in less than 8 hours and those for journeys over 8 hours long [Ślipseki et al. 2015]. In addition, the transporter is obliged to keep records for each vehicle used to transport animals in accordance with the applicable Regulation (Rozporządzenie Ministra Rolnictwa i Rozwoju Wsi z dnia 26 kwietnia 2004 r., Dz.U. 2004 Nr 100, poz. 1012). During the so-called long-lasting

transport there are also required such documents as transporter authorization type 2, journey log, documents specifying the origin of the animals and their owners, and the vehicle must be equipped with satellite navigation. It allows verifying the information contained in the journey log and record additional information about the opening or closing of the loading flap. The data obtained by the system must be kept for at least three years and made available at the request of the competent control authorities.

In addition, with effect from 4 November 2016 entered into force the Regulation of the Minister of Agriculture and Rural Development of 25 October 2016 amending the Regulation on the measures taken in connection with the occurrence of African swine fever (Dz.U. 2016 poz. 1770). In line with the new regulations, each transport of pigs, both transport between the farms and transport to the buying station will need to be equipped with a health certificate. Such certificates are issued by the District Veterinary Officer based on clinical examination of pigs carried out not later than 24 hours before moving a batch of pigs. The cost of providing this document is on the farmer. So far, the obligation of health certificates applied only to selected cases of livestock movements. Amendments to the Regulation are aimed at reducing the risk of the spread of African swine fever (ASF) in the country.

ORGANIZATIONAL ASPECTS OF LIVESTOCK TRANSPORT

Transport entails high stress to animals. This is due to the additional physical effort, the movement of the vehicle, change of the environment, and proceedings of people who deal with livestock [Averós et al. 2010]. For pigs it is unfavorable to combine animals from different herds, which introduces additional confusion among animals and provokes aggression. Therefore, transport should be planned in such a way as to avoid this. Good preparation and organization of transport allows to minimize the risks and control the animal welfare. The obligation to organize a transport so that it does not cause suffering or injury to the transported livestock rests on the transporter and the transport consignor. Transport starts with the loading operations and counts from that moment on. Loading time may vary from 30 minutes to up to 2 hours, it depends on whether the pigs are selected from the pens or go all together.

The rules also strictly define the maximum duration of transport and mandatory stops. To maintain the appropriate welfare of pigs during the journey, there must be observed the maximum transport time, which is 24 hours, if the animals have access to water [Marczuk 2014]. During long journeys, lasting more than 8 hours, the route must be divided into several stages. After every 9 hours of driving the animals should be guaranteed at least hour break. During this time, pigs should be watered

and fed [Gębska 2013a]. After a day transport animals must be given a 24-hour rest at the rest stops approved by the Chief Veterinary Inspectorate. The EU has 145 rest stops, including 10 in Poland, 51 in France, 19 in Germany [Gębska 2013b]. At their rest stops pigs are twice checked by a veterinarian. The first check is carried out upon arrival at the landing, and the second during reloading. The veterinarian checks whether a stocking density rules are obeyed and whether the animals are fit for further transport. Depending on the weight of the pigs in the vehicle admitted to transport up to 200 pig units can be transported. A stocking density during the transport of pigs weighing around 100 kg should not exceed 235 kg/m². In the case of piglets weighing 15 kg it is 0.13 m² and those of 25 kg – 0.15 m². Such standards require 1 m² for two fattening pigs, which is twice the area required in the pig farm. According to the breed of livestock and their physical condition, this standard may be increased by 20%. High concentration in the means of transport often leads to territorial fighting, resulting in injuries to pigs. Wounds, cuts, abrasions, and even damage to the tissues and bones of transported fattening pigs are often due to poorly conducted transports. It is estimated that the proportion of fattening pigs transported to slaughter which have wounds on the body resulting from transport conditions could be even 60%. The meat industry applies a device for transport and storage production waste caused by injuries. Approximately 6.5% of injuries account for are hyperemia, 5.1% for skin damage, 3.7% for fractures of the limbs. Most susceptible are heavy fattening pigs as well as those combined in a group although coming from different herds.

Loading of livestock is performed using a ramp and elevators. In this case, it is recommended to keep a maximum of 20 degree of the ramp sloping as this avoids slips and falls of livestock. In addition, the ramp should not be slippery, or with unmade surface and the side walls of the ramp should have a full finish which prevents livestock from observing the environment around them and reduces the risk of jamming the head or other body parts. For pigs it is also important how the ramps are lighted. It is easier for these animals to move from dimly lit places to brighter ones [Cierach and Idaszewska 2014]. When organizing a long-lasting transport, it is preferable to choose rest stops equipped with adequate ramps, slips ramps or elevators. Then the unloading and reloading is fast and efficient.

Injuries to animals are largely provoked by their physiological and genetic factors [Suterland et al. 2014]. They must be taken into account when organizing transport. Duroc pigs, for example, are more nervous and skittish than the white breeds therefore the loading staff must be aware of that and proceed calmly and quietly. An account should also be taken of the time of year and the ambient temperature. When it is cold most animals avoid lying during transport. In addition, pigs prefer

to combine in a close groups trying to warm each other, which can also cause an increased propensity for damage. On hot days there should be considered a lower stocking density and arranging stops in the shade because pigs are very sensitive to high temperatures [Averós et al. 2008]

Ensuring proper welfare during transport will minimize the stress that accompanies all the necessary operations. Keeping low levels of stress in pigs is very important as their stress gene is responsible for the quality of the meat [Averós et al. 2010].

Statistical data on the key indicators of welfare in the transport of pigs are slowly improving. Unsuitability for transport was observed in approximately 1.5% of livestock in 2005 and 2006, and in 2009 it decreased to 1% [Baultussen et al. 2011]. Table 3 presents selected indicators on the incidence of lameness, wounds and other skin damage in pigs. Mortality of pigs during transport are estimated as per individual EU countries from 0.03 to 0.8% [Axberg 2014].

Table 3. Incidence of lameness, severe injury (wounds, broken bones etc.), bruises, dehydration and exhaustion in years 2006 and 2009 in EU countries

Welfare indicators	The ratio in years (%)	
	2006	2009
Lameness	1.72	1.06
Bruises	1.91	1.41
Severe injury	1.44	1.06
Dehydration	1.69	1.08
Exhaustion	1.56	1.25

Source: Baultussen et al. [2011].

The number of injuries resulting from transport conditions is a good indicator of animal welfare. The data presented in Table 4 shows that the animal welfare improved in 2009 in comparison to 2006.

The biggest improvement was observed in the number of cases of lameness – in 2006 the ratio was 1.72% while in 2009 1.06%. All the other welfare indicators show lower number of reported bruises, injuries, cases of dehydration and exhaustion. This improvement was caused by Directive (EC) 1/2005 implementation.

In Poland inspections are carried out by Veterinary Inspection and Road Transport Inspection. Both organizations controlled 18 763 means of transport yearly in average. Data show that, in 2009 was the highest number of inspections (39 930 inspections), and lowest number of inspections was in 2011 (2 271). Average number of pigs controlled yearly during transport was about 1 038 554. Yearly, inspections covered from 41.33% (in 2012) to 78.23% (in 2009) of all pigs transported (Table 4).

Table 4. Results of inspections carried out during road transport of pigs in Poland in 2008–2015

Specification	2008	2009	2010	2011	2012	2013	2014	2015
Number of inspections								
In means of transport	29 905	39 930	35 244	2 271	2 356	2 874	33 594	22 619
In number of pigs	1 065 086	2 873 012	1 836 928	1 59 070	124 473	1 72 755	2 056 586	2 180 371
Number of infringements								
In means of transport	17	70	25	52	79	128	103	209
In number of pigs	219	457	375	2 039	120	1 998	1 562	3 135
Percentage of pigs inspected/ /transported (%)	62.09	78.23	66.06	66.15	41.33	59.98	64.68	66.21

Source: own work on data from Annual reports on the protection of animals during transport. Retrieved from: http://ec.europa.eu/food/animals/welfare/practice/transport/inspection-reports_en.pdf (Access: 15.09.2016).

The analysis of the information concerning main problems detected during inspections shows that non-compliance with Council Regulation (EC) 1/2005 was found every year. The most frequently observed problem concerned the documentation such as approval for transporter, certificate for mean of transport, license for driver and journey log (454 cases in 2009, 199 cases in 2012). Next type of infringements concerned construction and technical condition of mean of transport (231 cases in 2012). Important issue was fitness for transport of pigs, animals were often in poor condition. This infringement was observe in 179 cases in 2012. Very often irregularities concerned improper fitness of pigs for transport. Important deficiencies reported was exceeding time of transport, 179 cases in 2012 and 93 in 2015 (Table 5).

Data presented in Table 5 show, that the total number of infringements decreased from 1 082 in 2008 to 103 in 2014 and to 209 in 2015. Important improvement was observed from animal welfare point of view, because density was lowered and improved construction of means of transport. Problems with handling and watering and feeding were almost eliminated.

This improvement was achieved because of many training activities conducted for veterinary officers in years 2009–2013. Many important subjects were presented and discussed with regional veterinary officers and district veterinary officers. At the same time significantly increased number and frequency of controls of animal welfare during transport.

Table 5. Type of infringements found during inspections concerning road transport of pigs in Poland in 2008–2009 and 2012–2015

Type of infringements found	2008	2009	2012	2014	2015
Fitness for transport	21	32	179	1	93
Density	65	20	40	4	1
Ventilation	16	3	7	0	1
Construction and technical condition of mean of transport	98	159	231	23	12
Segregation of animals	4	5	4	0	0
Lack of certificate for mean of transport	33	14	35	53 ^a	86 ^a
Lack of licence for driver and attendance	58	2	4		
Lack for approval for transporter	7	43	36		
Lack or improperly filled journey log	31	96	124		
Loading – unloading [documentation and equipment in accordance to Council Regulation (EC) 1/2005]	156	324	36		
Exceeding time of transport	94	52	33	1 ^a	6 ^a
Required rests feeding and watering of animals	6	2	23		
Dealing with animals	7	29	20	3	–
Others	486	3 061	13	18	22
Total	1 082	3 842	1 135	103	209

^aIn 2014 and 2015 the way of presenting data in annual report was changed, categories of infringements concerning documentation were summarize as well as categories of infringements concerning feeding, watering and time of transport.

Source: own work on data from Annual reports on the protection of animals during transport http://ec.europa.eu/food/animals/welfare/practice/transport/inspection-reports_en.pdf (Access: 15.09.2016).

SUMMARY

Transport of animals is necessary. It can not be avoided but it can be limited. It is a very responsible activity, requiring knowledge of the applicable legislation and the rules of proceedings with animals. Numerous factors affecting the very process and the end result of transportation are a challenge for both pig producers and operators providing transport services. Badly organized transport, without respect for the relevant legislation, results in lower welfare of pigs and often in financial loss. Results of the study shows that in Poland non-compliance with Council Regulation (EC) 1/2005 decreased. Less frequent are problems concerning transport documentation. Construction and technical condition of vehicles used for the transport of animals has significantly improved. Very important that decreased the number of cases of transporting pigs not fit for transport. Results of the study suggest that awareness of transporters has increased and at the same time compliance with the law has

improved. It is clear that actions taken by the European Commission in order to improve legislation, on animal transport and its implementation bring good results. Unified requirements for all Member States, as well as annual reporting on the transport control should have a positive effect in the long term.

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TENDENCIES IN PRODUCTION, STRUCTURE OF PIG HERDS AND POLISH TRADE IN PORK

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Abstract. The paper presents the main trends in exports and imports of pork. Tabular, graphical, descriptive and trend analysis were used in the course of the analysis. Polish trade of live, meat and pork preparations for the years 2004–2015 has improved significantly. The direct cause of this phenomenon was the Polish accession to the European Union. Free movement of products between the countries of the community, competitive prices and good quality of meat allowed to sell to EU countries the majority of production. The analyses show that EUR exchange rate had a strong influence on trade turnover. Price fluctuations resulting from changes in the value of PLN on the European market have contributed to the volatility of market pigs. The price of livestock proposed Polish manufacturer was significantly influenced by economic problems. Along with its growth, it decreases its exports. Foreign trade was influenced by the profitability of production in countries, which are major European manufacturers, such as Denmark, Germany, the Netherlands and Belgium.

Key words: production, trade, pork

INTRODUCTION

Pig production is one of the main branches of Poland's agriculture. In addition to milk and crop production, breeding and farming of pigs is an important source of income for many agricultural producers. Pork, despite the changing eating habits, is the most consumed meat.

The pork production depends on various factors, mainly macroeconomic and local. The macroeconomic factors include: macroeconomic conditions, demographic and social factors, state planning, production profitability and other. The local factors include conditioning lows concerning production and pork sickness [Stępień 2013, Wojtasik-Kalinowska et al. 2014].

The pork production is diversified in the world. Asia (59.9%) and Europe (21%) are places where pork production is most concentrated. More than 80% of pork production is located in these two continents [Gołaś and Kozera 2008]. Factors having an impact on pork production in EU include: fodder prices and production profitability and other. The increasing prices of grain leads to changes in the global production, elimination small producers from the market and production concentration in big farms [Stepień 2014].

Poland is one of the largest pork producers in the EU. A number of manufacturers that are able to provide the minimum desired size of the pig (300 heads) were too small to cover the need of producers of pigs for fattening. Mainly the animals have been imported from Denmark, but also from Germany and the Netherlands.

To increase demand for the domestic animals and thus limiting their import seems to be necessary to support Polish producers of piglets. Polish exports were mainly to EU countries. Detection of African swine fever in 2014 was the cause of the embargo on Poland. The ban on the export of pigs and pork products in Eastern Asia has caused the loss of the market. The observance of all precautions to prevent new outbreaks of African swine fever, allow attempts to negotiate with the countries that refused to buy Polish meat, and the search for new, alternative markets of pork what can have a significant impact on the growth of the industry in Poland.

In Poland in 2004–2007 pork imports dominated exports of pork and since 2008 exports dominated imports. In particular, the change trends have impacted on increased buying piglets and weaners and it is a consequence of the fall breeding sows and the decrease in export of pigs for fattening.

THE PURPOSE AND METHODOLOGY OF RESEARCH

The aim of the study is the evaluation of the scale of production and total trade of Polish pork. In the framework of the main objective, the following specific purposes were established:

- inventory of pigs in Poland in the years 2004–2015 since Polish accession to the European Union;
- diagnose the structure of the pig herd in Poland;
- assess the changes in the external trade of pork.

The analysis used trend, tabular, graphical, and descriptive methods. The authors used the elements of cause – effect analysis to find the reasons for the observed occurrences. The time was 2004–2015. The authors used data from Pig Market in Poland published by Institute of Agricultural and Food Economics – National Research Institute.

PIG POPULATION AND THE STRUCTURE OF PIG HERDS

The pig production is characterized by permanent changes in production. The state and constant imbalance between demand and supply created different prices and profitability [Stańko 2012]. The net model is explaining the reason for these changes. High price of meat leads to production increase what has an impact on lower prices next period [Stępień 2015].

The volume of production of pork is strictly dependent on the size of the herd and productivity. After Poland's accession to the EU, a sharp drop in pork was recorded (Table 1). In 2004 it amounted to 17 million, and in 2015, at 11.5 million units [Rynek mięsa wieprzowego 2016].

Table 1. Pork herd in Poland in the years 2004–2015

Specification	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
	herd (thousand heads)											
Total	17 396	18 711	18 813	17 621	15 687	13 287	13 967	13 100	11 480	10 931	11 186	11 511
Sows	1 649	1 808	1 786	1 587	1 423	1 349	1 382	1 168	1 113	1 007	1 010	962
Remained pigs	15 747	16 903	17 027	16 034	14 264	11 938	12 585	11 932	10 367	9 924	10 176	10 549

Source: Rynek mięsa wieprzowego [2016].

Reasons for the decline are many, but the most significant is the decline in profitability caused by an adverse pork-feed price ratio, prices of crops and forages. The entry into the EU also preserved of a declining trend. Adaptation of farms to the strict requirements of the EU in a relatively short time was costly and did not have influence on production efficiency [Pejsak 2012].

Currently, the largest producer of pork in the world is China, which in 2011 produced 49.5 million tons of pork. The second producer of pork in the world is the EU, which produces about half the meat from China. The third producer of pork in the world is the United States, which in comparison with China produce about 80% less pork [Knecht and Środoń 2013].

Figure 1 plots the dynamics of sows, remained pigs and total pigs in Poland. As we can see the numbers went down particularly from 2008 what created the deficit of pork on Polish market.

Figure 2 plots the indicators change of pigs. The heads of piglets in individual farms decreased by 13.7%, piglets (20–50 kg) for 12.3%, finishers (above 50 kg) by 17% and sows (15.9%) in 2016 in comparison to 2015.

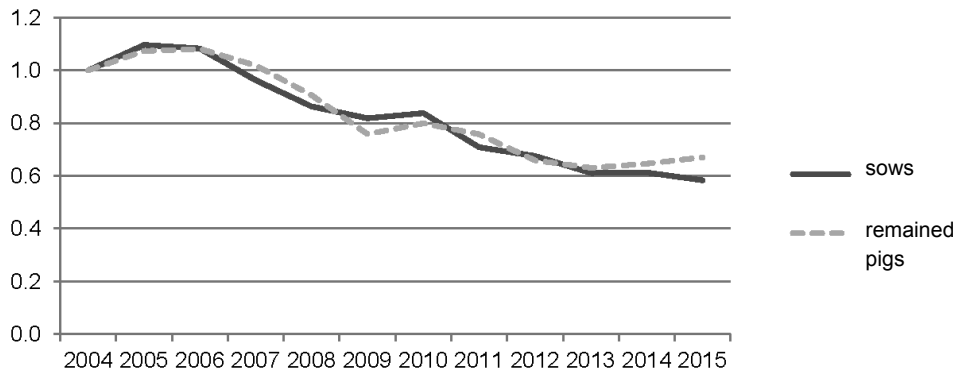


Figure 1. The dynamics of total pigs, sows and remained pigs in Poland in the years 2004–2015
Source: Rynek mięsa wieprzowego [2016].

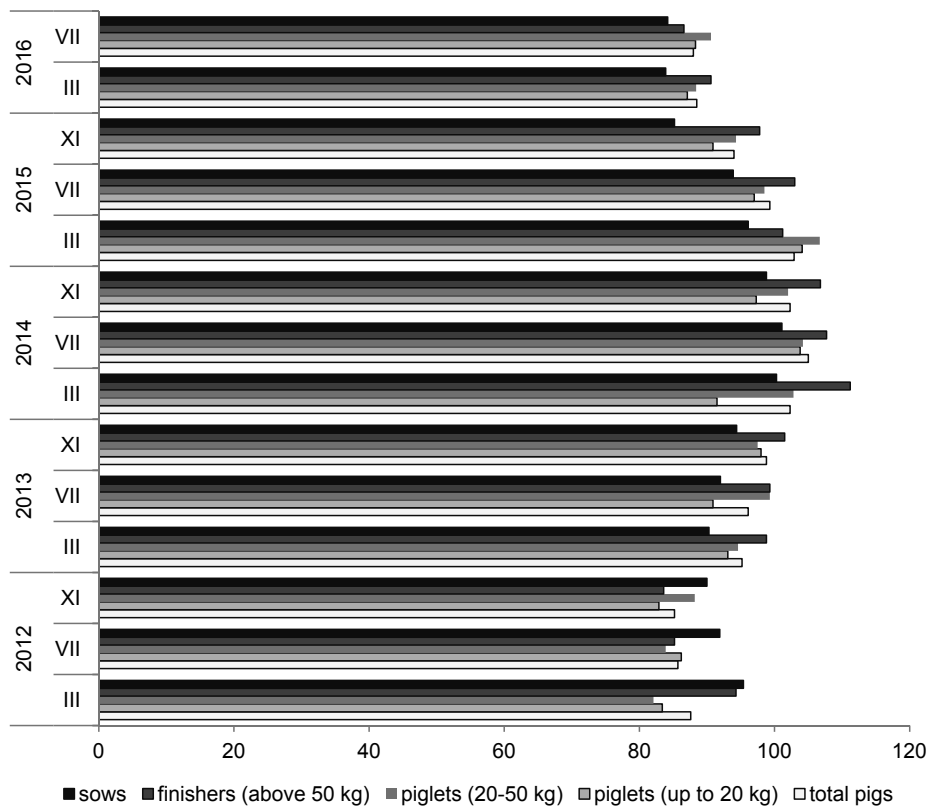


Figure 2. Structure of indicators change of pigs (the same months of previous year = 100)
Source: Rynek mięsa stan i perspektywy [2016].

Until December 2015 Poland brought 4 237.7 thousand animals at medium weight 29.5 kg, i.e. imports was higher by 8.3% than the same period in 2014 [Rynek... 2016] and almost four times higher than in 2004. The Polish shortage of pigs (weight 50 kg) is filled from Denmark, the Netherlands and Germany. The reason for the growing imports is the lack of a sufficient number of producers of piglets in Poland. The greatest demand is for a batch of 200–300 pigs, a herd that is too small to economically sell [Blicharski and Hammermeister 2013].

The herd structure in Poland is not profitable (38% sows). Systematically reducing the number of sows and consequently also of the piglets is a very big problem (Fig. 3).

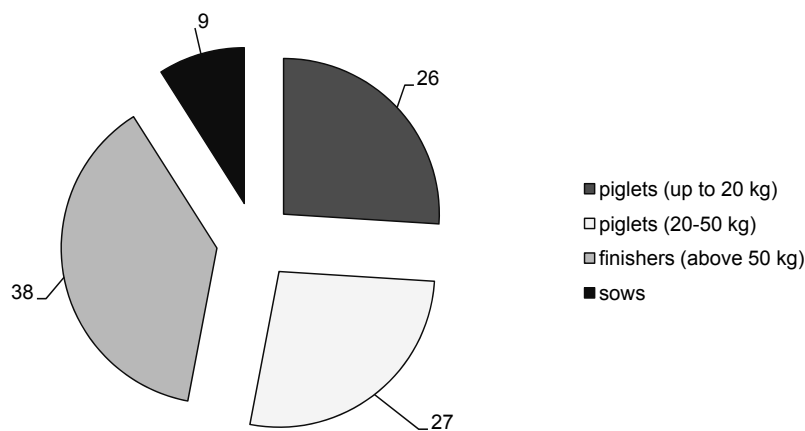


Figure 3. Structure of pig herd in Poland in 2015
Source: Rynek mięsa wieprzowego [2016].

In 2004, 1 649 thousand sows have shrunk to 962 thousand in 2015 (i.e. a 41.6% decrease) [Rynek... 2016]. A great shortage of feeder pigs in the weight category up to 50 kg (only 27% of the total herd) has led 2015 to the need to import animals at this group age (approx. 2/3 of national imports).

Selling piglets and weaners in Poland has been small (from a few hundred animals to 24 thousand animals). In Poland in the period 2004–2008 dominated the export of pigs for fattening, and since 2009 imports began to dominate. In 2015 (compared to 2004) it was 25 times higher.

In the period under review the largest share in the export always had pigs weighing more than 50 kg. In 2015 680 thousand head of pigs was brought to Poland from Germany, and in 2015, more than half (340 thousand head). Export volumes have been significantly reduced. In 2004 it amounted to 122 thousand head, and in 2014 only 54 thousand.

FOREIGN TOTAL TRADE OF PORK

Poland's accession to the EU significantly influenced the volume of foreign trade. After the accession (2004–2008) significant growth in pork exports occurred, at the rate of 22% per annum and imports 41%. In subsequent years (2009–2013) this trend continued, but at a lower level, amounting to more than 10% (Table 2). Trade increased, primarily from Common countries, and this was due mainly from competitive prices from refiners and producers [Mroczek 2009]. In the case of foreign trade, a very important role is played by the competitiveness of this type of meat compared to other countries.

Table 2. Polish foreign trade in pork

Year	Exports	Imports	Balance	Exports	Imports	Balance
	thousand tons			million EUR		
2004	193.0	115.0	78.0	276.1	182.6	93.5
2005	243.0	197.0	46.0	380.9	322.7	58.2
2006	329.5	178.3	151.2	589.0	345.1	243.9
2007	332.6	197.0	135.6	594.5	381.3	218.7
2008	270.0	230.0	40.0	512.6	435.6	64.5
2009	336.6	614.8	-278.2	639.9	1164.4	-524.5
2010	418.4	601.9	-183.5	833.2	1169.2	-336.0
2011	502.8	675.2	-172.4	1031.3	1346.7	-315.4
2012	588.4	748.7	-160.3	1304.5	1628.4	-323.9
2013	705.6	819.0	-113.4	1530.5	1814.0	-283.5
2014	622.4	822.1	-199.7	1304.3	1754.1	-248.0
2015	644.5	829.4	-184.9	1309.1	1618.8	-309.7
2016	629.0	850.0	-221.0	1280.0	1656.0	-376.0

Source: elaborations on the basis Rynek mięsa wieprzowego [2016].

The research implies that the competitiveness of domestic pork in the European Union declined. A persistent negative balance of foreign trade, high production costs and low prices are considered to be the immediate causes of this phenomenon. In Poland, the cost of production in 2010 amounted to 145.1 EUR per head in recalculation on 100 kg of post-slaughter cold, and above costs recorded only the Czech Republic (192.5 EUR), Italy (175 EUR), the United Kingdom (166.7 EUR) and Germany (149.4 EUR). The lowest cost was in France (136.3 EUR) [Szymańska 2014].

Trade also depends on domestic consumption. Pork in Poland is one of the most widely eaten meats and its consumption is steadily increasing. In 2014, a typical resident ate 39.10 kg, and in 2015 about 40 kg. Impact on the increase in consumption was a reduction in retail prices for meat. Consumption, however, does not depend on

production volume. Any gaps are filled with an elastic imports from other countries [Polski handel zagraniczny... 2016].

After joining the EU pork exports have undergone significant improvement. Before joining, it was more than 40% of the 2013 exports, when it amounted to 638 thousand tons. In 2014, it declined to 625 thousand tons and in the following year rose to 640 thousand tons [Polski handel zagraniczny... 2016].

The foods structure was varied. Primarily chilled and frozen meat dominated. The piglets have the smallest share, which in 2004 was 7% and in 2014 only 1% [Pasińska 2015].

Exports of meat products in Poland increased by 7%, and thus reached 300 thousand tons and 933.2 million EUR in 2010. This growth resulted from increased sales in the EU, respectively, by 9% in quantitative terms (to 285 thousand tons) and by 8% in value terms (up to 845 million EUR).

Most meat products have been exported to the UK with a share of 34 and 36% in value, to Germany with 8 and 10% share and to Slovakia with 6 and 7% share. Many meat products from other countries were shipped to the USA (3% share of the weight, and 4% of value) [Polski handel zagraniczny... 2016].

Imports also improved. In 2015, Poland bought more than 16 times more pork products than it did before accession to EU. Most of the imported pork was frozen and chilled meat and low products. Imports of pork have gradually increased in the value, which in turn was associated with a reduction in pigs heads in Poland [Pasińska 2016].

The largest consumers of Polish meat are European Union countries, where 80% of exports go, and the EU is the main source of imports. A lot of Polish pork in 2015 year was purchased including: Italy (52.9 thousand tons, which was 15.6% of total exports), Germany (39.6 thousand tons; 11.7%) and Slovakia (31.3 thousand tons; 9.2%). In addition, 17.6 thousand tons; 5.2% was bought by the USA, Lithuania and Hong Kong bought 17.2 thousand tons; 5.1% each. The greatest fall in exports from these countries took place in Hong Kong: 45% in volume and 47% against value, the biggest increase in USA (28% volume; 19% of the value). On Figure 3 we can see the dynamics of exports, imports and balance of Polish trade. The beginning of market problems began in 2008 and it is still ongoing.

Imports were mainly from: Belgium (156.5 thousand tons; 27.9%), Germany (136.3 thousand tons; 24.3%) and Denmark (104.0 thousand tons; 18.5%). First place in value of pork exports was taken by Italy (to 82.4 million EUR), in pork exports – Germany (290.1 million EUR). Share of 50.7% (2.3 thousand head tons) was exported to the Czech Republic, 23.2% to Germany (1.1 thousand tons) and 7.3% in Romania (3.34 thousand tons).

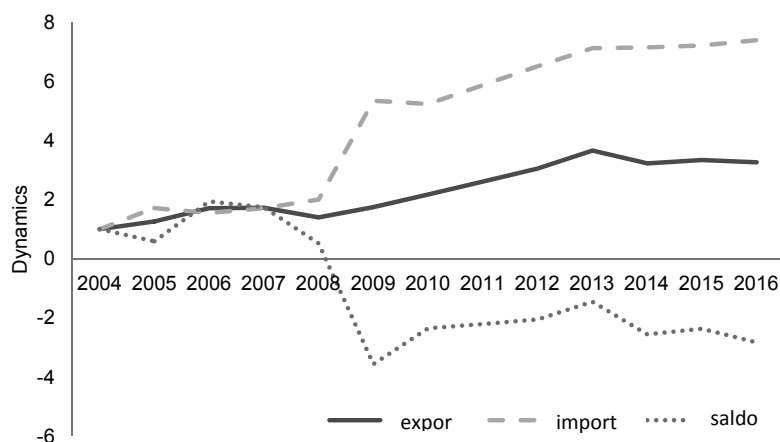


Figure 4. The dynamics of Polish pork trade in the years 2004–2016
Source: own elaboration on the basis of Rynek mięsa wieprzowego.

The main sources of imports was Denmark 98.5 thousand tons (3 249.3 thousand head) and Germany 38.8 tons (621.0 thousand head). In terms of value the first place in exports was taken by the Czech Republic (2.6 million EUR) and the second Germany (1.2 million EUR) [Aktualna sytuacja na rynku trzody chlewnej 2016]. Poland in 2013 had a stable market. Detection of African swine fever in Podlaskie voivodeship in 2014 impacted negatively on the turnover and export of pigs and pork meat. Poland was threatened with an embargo due to ban the export of pork and all pork meat products from Eastern Europe and Asian countries, particularly China, Japan, Korea, Belarus, Ukraine and Russia [Szymańska 2014].

In 2013, exports of pork products amounted to 445 thousand tons, and in 2014 has decreased by approximately 15% and only amounted to 383 thousand tons. Due to the loss of sales, Poland has increased its exports to other EU countries, from 63 to 82%.

In 2015, there was 6% growth of exports of pig meat, mainly to: Kyrgyzstan, Albania, Ukraine and Uzbekistan. Singapore is the state for which Poland as a result of negotiations, resumed exports. However, some restrictions were put on exports to: Kyrgyzstan and Albania (import is permitted from areas of Poland not limited), Ukraine, Uzbekistan (the termination of the ban on the export of Podlaskie voivodeship), Ukraine – no restrictions permitted unless the meat is subjected to heat treatment, Singapore (the need to perform additional studies on the presence of ASF) [Aktualna sytuacja na rynku trzody chlewnej 2016].

In 2014, most of pork and pigs exported from Poland went to: Italy (12.6%), Slovakia (11.9%) and the Czech Republic (10.5%). In 2015, Italy was still the largest importer of Polish pork (13.5% of export value). The Czech Republic took second

place and Slovakia was third. The exports to these countries increased by 0.7% in the case of the Czech Republic and decreased by 1.5% in the case of Slovakia. In addition, of the title leading importer of Polish pork and pigs in 2014 belonged to: Germany, USA, Hong Kong and Hungary, and in 2015: the USA, Germany, the UK, and Latvia (Fig. 5).

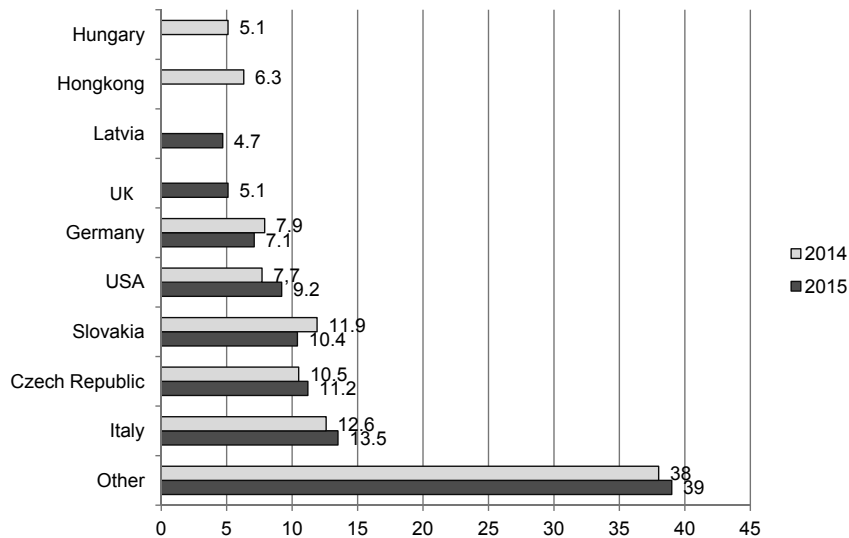


Figure 5. Geographic structure of exports of pork according to value (%)

Source: Elaboration based on Rynek mięsa wieprzowego [2016].

In Poland you can notice a visible fall in exports and a simultaneous increase of the imports of swine. Since 2008, Poland has become a net importer of pork and this tendency continued until the end of the study period (2015). It is a completely different scenario than in the case of developing and highly developed countries, where exports exceed imports. The immediate cause of the growth of imports is the decline of pigs heads, which reduced the profitability of production for high fineness farms.

The national trade deficit has been steadily deepening. For many years 2004–2013 the value of import compared to export value rose by 121.5 times [Czarny and Śledziewka 2015]. In world exports, the share of Poland is small. In 2004–2006, it was 1.7%, in 2007–2009 there was a tendency to decrease, then in 2013 there was a growth of 0.4% [Pasińska 2016]. In the case of pork imports Poland is becoming a bigger customer. From 2004 to 2007 a positive balance of trade stayed, than in 2007–2009 a sharp decline was registered due to the economic crisis, and after this period, the pork trade balance sheet gradually changed and improved. In the same way as in

developed countries, the exports exceed imports. In developing countries, on the contrary – imports exceed exports [Czarny and Śledziwska 2015].

The biggest import source of pork and pigs in Poland for both 2014 and 2015 took place from Germany (respectively 29.7 and 27.6% of the total value of imports), Belgium (22.5; 23.6%) and Denmark (16.8; 14.8%). In the case of Germany and Denmark, in 2015 the volume of imports in comparison to 2014 decreased respectively by 2.1 and 2%), and there was a slight increase in imports (1.1%) from Belgium. At the forefront of the countries from which Poland buys a lot of meat are the Netherlands, Spain and the UK (including in 2014 from these countries Poland imported 24.3% and in 2015 – 26.3%) – Figure 6.

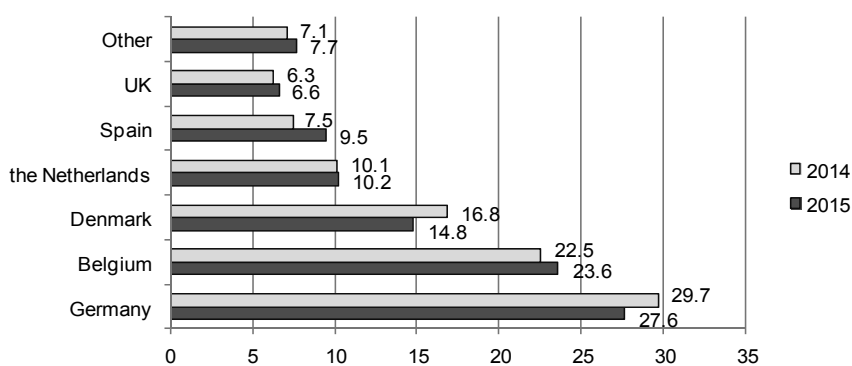


Figure 6. Geographical structure of import according value (%)
Source: elaborations on the basis Rynek mięsa wieprzowego [2016].

Poland is not self-sufficient in terms of pork production. Since 2008, when there was a collapse of domestic production, Poland has been a net importer, and the level of self-sufficiency has decreased. On average in 2004 it amounted to About 105% [Blicharski and Hammermaister 2013], and in 2013 amounted to only about 93%. This means that Poland is even theoretically not able to meet its domestic pork consumption needs [Aktualna sytuacja na rynku trzody chlewnej 2016]. For comparison, in EU, in 2007, the highest figure was recorded in Denmark – 699%, and the lowest in Belgium – 35%. In Poland in the same period it amounted to 101% [Blicharski and Hammermaister 2013].

The unstable value of the EUR, in the years 2004–2015 contributed to fluctuations of Polish pork exports and imports. Increase the value of the Polish currency against the EUR caused a temporary increase in imports and decrease in its value resulted in export growth. The cost of production is diversified in Poland. The average cost of production of pork in 2012 was almost 80% higher than in 2006. In 2010–2012, the highest costs were incurred in the Warmia-Mazury, while in

Małopolskie and Mazowieckie voivodeships costs moved closer to the average level in the country [Pepliński 2013].

The changes of grain prices and foddors were small in 2015–2016. The relations of pork price to rye and foddors decreased in the 2015/2016 season. The relation of pork price to rye price was 1 : 7.2, pork to barley 1 : 6.0, pork to foddors 1 : 3.1 (Fig. 7). This lead to decrease in pig heads for 6% and in sows for 16.4%.

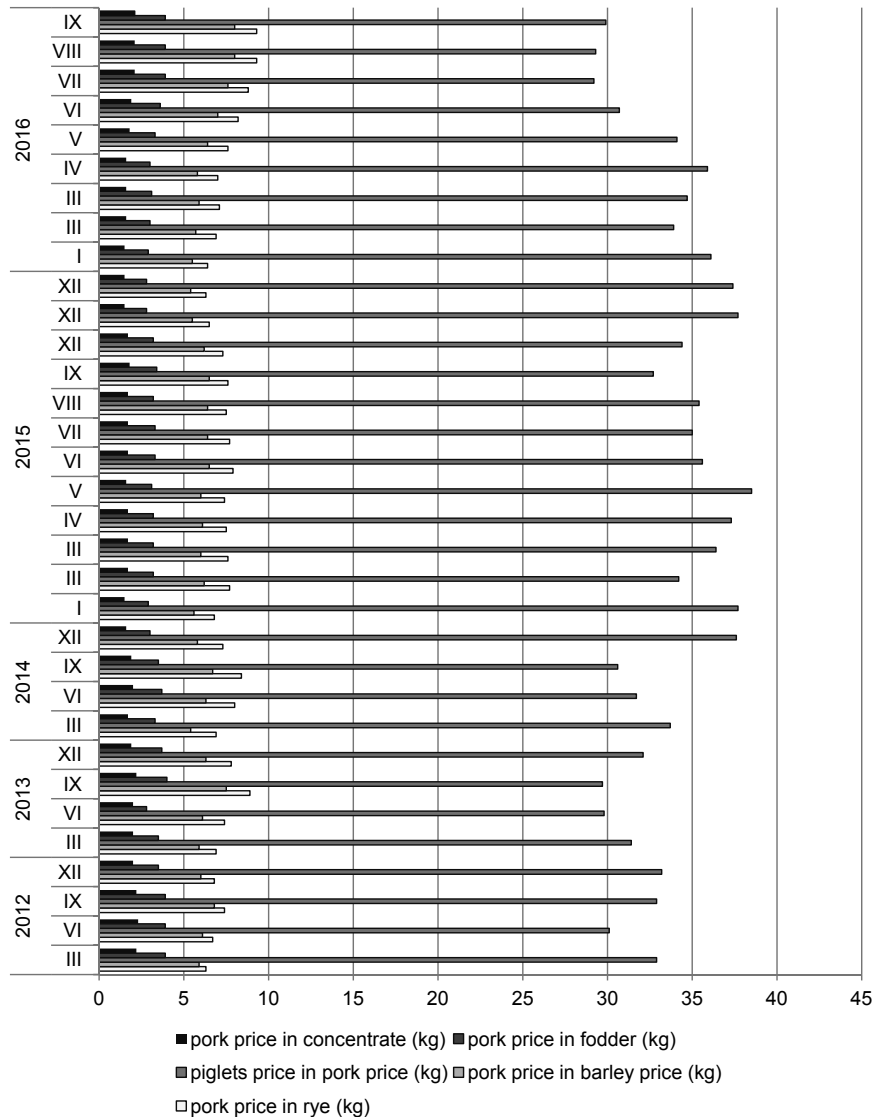


Figure 7. Pork and piglets prices in rye, barley, foddors and concentrate
Source: Rynek mięsa – stan i perspektywy [2016].

An integral factor influencing exports and imports is price. Attractive prices on pigs and grain ensure profitability of pork. Even before Poland's accession to the EU and during the first three years of membership, the ratio of the prices of pigs to the prices of rye stayed in the range of 1 : 8, 1 : 11. In the period 2005–2007 it changed to the amendments and amounted to 1 : 5.5, while the minimum threshold of profitability was 1 : 7.8.

The years 2007 and 2008 were particularly unfavorable. The sharp decline in prices of pork combined with very high prices of cereals meant that in the period 2007–2008 the breeder should pay 86–84 PLN/100 kg live weight.

The lack of profitability led to lower production, which was replaced by imports and fewer exports [Mroczek 2009]. After the end of 2008, the ratio of the pork prices compared to the grain price began to improve gradually.

SUMMARY

The number of pigs fell significantly during the years 2004–2015. The analysis showed that the sharp drop in the number of grown sows in Poland had a negative impact on the structure of the herd. The resulting shortage of pigs led to about 2/3 of the country's import of pork being the import of animals up to 20 kg. The analysis shows that the accession of Poland to the EU has had a positive impact on the trade balance of pork. The situation changed in 2008 when import exceeded export what created a negative balance of pork trade. The particular growth of exports and imports was observed in the EU countries.

The free movement of goods between Member States and a common trade policy are factors that can be considered as a direct cause of the growth of foreign trade. Most pork meat was exported to: the Czech Republic (2.3 thousand tons), Germany (1.1 thousand tons) and Romania (3.34 thousand tons). Since 2008, Poland is a net importer of pork in particular from Denmark (98.5 tons) and Germany (from 38.8 thousand tons). This result points to the big problem of reducing the swine herd due to a frequent lack of profitability.

Pork exports from year to year are gaining importance. The main buyers of meat are the EU countries, among them most are exported to: Italy (52.9 thousand tons), Germany (39.6 thousand tones) and Slovakia (31.3 thousand tons). The greatest number of imported meat comes from: Belgium (156.5 thousand tons), Germany (136.3 thousand tons) and Denmark (104.0 thousand tons). The analysis showed that trade with countries not belonging to the EU is equally important.

The embargo imposed on Poland due to the detection of African swine fever led to the loss of markets for pork products. Despite the increase in sales to EU countries in 2014 compared with 2013 overall pork exports dropped about 15%.

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MANAGEMENT PROBLEMS OF PIG FARMING INDUSTRY IN UKRAINE IN THE CONTEXT OF THE ESTABLISHMENT OF FREE TRADE AREA WITH THE EUROPEAN UNION

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Abstract. The problem of pork market in Ukraine and the possibility of its implementation on international markets are considered in the article. An unadjusted system of production, processing, and certification of this type of product creates obstacles for it. The proposed system of presenting information, certification and processing will give an opportunity to compete in foreign markets of the EU, the USA, and China.

Key words: pork, market, competition, information system

INTRODUCTION

Today Ukraine is confidently moving towards the European Union. Around the world products based on safety, health and ecological factors are popular among consumers. Ukrainian agricultural products of high quality have a significant export potential on the international market. The market of the European Union countries is potentially attractive for Ukrainian pork. It is difficult for our Ukrainian manufacturer to enter it because it is already saturated, and Europe itself is one of the largest exporters of pork in the world.

The international pork market is extremely competitive. EU countries, the USA, Canada and Brazil play a major role in this market. They will continue to get the championship of the pork market in next years because they have already developed technological chains of interactions, clearly distributed roles from producer to slaughter of animals, from slaughter to technological processing and then from processing to products sale (wholesale or retail). Since they are key players and define quality standards, so the certificates and quality standards are important for us.

PURPOSE AND RESEARCH METHODOLOGY

Ensuring of food security is one of the main tasks of the government. Creating a clear program of industries development, including the pig farming industry, sets well-defined objectives and outlines the progress prospects. In our opinion pig farming industry has the following problems to be solved and they will become the object of our publication:

- the inability of the determination of export and import volumes;
- the absence of an accurate information on imported products in Ukraine for proper and timely planning and responding to market changes of pig farming products;
- methods of improving market and government pricing policy;
- imperfect protection of Ukrainian product manufacturer and unfavorable financial state in foreign markets;
- improve cooperation with the EU and Poland.

The main method of study was empirical method that made it possible from the current state to give certain conclusion. Comparison is the basis of the logical device, as an analogy, and serves as a starting point for comparative-historical method. The analysis used to assess the current state of pig. Generalization or synthesis used to establish the general properties and characteristics of objects.

RESEARCH RESULTS AND POSSIBLY DISCUSSION

International markets impose strict requirements to imported goods. Therefore, providing new opportunities for pork producers, they require adherence to international norms and standards of animals growing. The problem of most of Ukrainian pork producers is the absence of the certified system of slaughter. So, we need to make the quality of the final product according to the EU countries veterinary standards, and the norms of large trading networks.

Therefore, now, the EU does not import a lot of pork from Ukraine, but if we do our best to reach its standards, which are the highest in the world, then in the future we will be able to export raw materials not only to the EU markets but also the markets of the Near East and the Middle East as well as the countries of Asia.

The attitude of Ukrainian industrial manufacturers of pork, small pig farms, experts and the public to international prospects and requirements are still controversial: some see them as opportunities for growth and development, others cautiously alert about unavailability of pig farming sub complex to compete with the world leading enterprises. Obviously, international cooperation of sub complex is related

with the overcoming of a number of difficult barriers: legal, economic, social, psychological ones. Therefore, the integration occurs slowly but gradually, taking into account the positive experience of other countries and it is based on an objective assessment of internal potential and external conditions.

Ukrainian producer is interested in deepening cooperation with Europe and enhancing investment cooperation in the sub complex of pig farming. It requires a clear, unified development strategy in pig farming industry for a period of 5 years, which will create conditions for business development and favorable conditions for obtaining foreign investment for the development of Ukrainian producers.

In a situation of high cost of the sold goods, low demand for it on the Ukrainian market and inflation, the only instrument of salvation is export. However, Ukrainian pig farming industry has been on the halfway to the real possibilities of export for a long time. When the whole world practically exports the processed meat, Ukraine continues to try to export the carcasses. Such products usually entered the Russian market, where it was further processed. However, in recent years there is a great probability that Russia will introduce embargo on Ukrainian products supply to its market. Therefore, we will lose virtually all exports that took place from 1 January 2016. So, as a usual, Russia exceeded 90–95% in pork export, and next year production is likely to remain at the same level as in 2015 – about 740–750 thousand tons. An excess of supply will put pressure on the Ukrainian market and reduce prices even more because of the absence of proper demand.

Pig farming industry must be diversified, spreading risks on different types of products. On the basis of rural regions clustering one should develop a program of setting up processing complexes on the manufacturing of pre-fabricated products for Ukrainian and foreign markets, which will create jobs in rural areas and enhance rural population.

Markets of China, Japan and South Korea, countries, which are the world largest importers of pork, are very promising for Ukrainian pork export. Of course, the Ukrainian manufacturer wants to enter these markets, but this direction implementation requires certain steps to be taken – the coordination of veterinary certificates, the study of the requirements of these markets, the search of a potential buyer.

In 2015 pork import amounted to 3.6 thousand tons. Share of 98% was for other frozen products. The main country-supplier was Germany, ahead of Brazil, which in 2014 was the first of pork suppliers to Ukraine. An active pork purchasing activity of the Netherlands made the Polish pigs' meat occupy the fourth place in the rating of pork importers. The general condition of Ukraine's trade of pork and pig by-products in 2015 is represented in Figure 1.

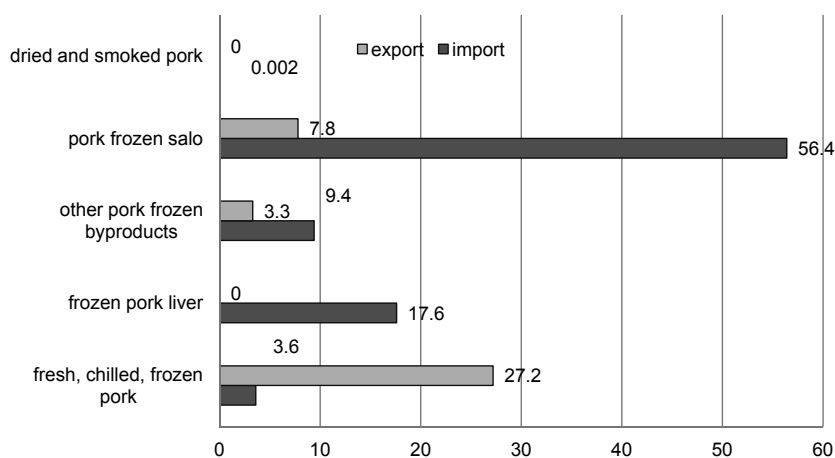


Figure 1. Foreign trade of pork and pig by-products in 2015 (thousand tons)

Source: <http://asu.pigua.info/uk/news/8634/>.

For the first 6 months of 2016 pork import to Ukraine (in dollar equivalent) decreased by 36% (to 3.3 million USD) compared to the same period in 2015 (5.1 million USD). According to authorities, purchases of pork abroad rose by 5.3% and totaled 2.3 thousand tons. For the first 7 months of this year the average price of imported pork fell by 40%.

The main countries-suppliers for the first 7 months became the EU countries: Germany – with a share of 48.8% of all imported pork (1.6 million USD), Poland – 20.2% (0.7 million USD) and the Netherlands – 16.6% (0.5 million USD). Fiscals reported that in total, three leaders supply 85.6% of pork to Ukraine.

As we know, Ukraine has established a tariff quota for duty-free import of pork from the EU as to the terms of the Free Trade Area with the European Union. According to State Fiscal Service data, on 1 September, 2016 the European Union countries have used only 22.2% of duty-free quota for the supply of these products, that is, 2.2 tons within the quota was imported to Ukraine (initial quota – 10 thousand tons, the rest – 7.7 tons).

A clear, strategic and tactical planning is necessary for all economic sectors, including the pork production. Imperfect legislation, poor technical equipment, the price disparity, lack of control and constant changes in government policy created a situation which led to the illegal import of pork from abroad. It causes problems in determining the volume of pork import and possibility to respond to market changes.

Western Ukraine suffers from illegal meat import, mainly due to the supply of pork, fat, skin and pig carcasses from neighboring states of Ukraine, usually on the border with Poland. It should be noted that meat, imported to Ukraine from Poland

illegally is not a qualitative product. It is mainly pork of the fourth category. Semi-legal processed products of meat processing enterprises, private shops in Poland go to the markets or small processing workshops of Lviv region without quality testing. Thus, it leads to lower prices of the meat market and causes economic and social losses for Lviv manufacturers [Shybunko 2013].

According to various reports, there are a lot of illegal products on the Ukrainian market today, that affect the Ukrainian price of meat, inability to carry out the count of its production needs and more. State has damage from smuggling.

One of the main problems in the market of pig farming production is the system of information providing that makes it impossible to check product quality. Some products are produced on private farms, where state control is completely absent. According to statistical data, on 1 February, 2016 the total number of cattle was 3.8 million heads (for 3.6% less than on 1 February 2015), including cows – 2.2 million heads (for 4.5% less), pigs – 7 million (for 3.7% less), sheep and goats – 1.4 million (for 4.9% less), poultry of all kinds – 198.9 million heads (3.8% less). In households people held 66.7% of the total number of cattle, including cows – 76.8%, pigs – 46.4%, sheep and goats – 85.6%, poultry of all kinds – 43.1%.

Since 46.4% of pigs are kept in households, which is about 3.2 million heads, this figure is very relative. For proper certification of pork for its further implementation one must know the history of growing from birth to slaughter. We believe it is necessary in law to stipulate the need of reporting systems in households.

It can be done by introducing the state program on informatization of production. The dominant economic process is the transition of developed societies to the era of informative civilization. The scales of the process determine factors that will have a crucial impact on competition of economies. Complete and comprehensive use of computer technology encourages employees to faithful implementation of tasks, reducing the negative effects of man – man interactions, rate of information flow and conducting analysis. Automation of processes should be comprehensive and start with everyday things. Society needs to understand the basic principles relating to the effective functioning of electronic systems, namely the absence of corruption and the possibility of planning time, visual display of results, the opportunity of control over all processes at all levels, the need of modeling of the decisions made prior to their practical implementation and more.

The introduction of information technologies in agricultural production faces many challenges, including: the lack of necessary equipment locally, the lack of technique introduction of new technologies, the high cost of proposed products, unawareness of staff, lack of the relevant information processing systems at national level.

We consider that the available means of information processing that are not the newest computer, tablet, mobile phone can be used for the management system. In the software market there are many products that are designed to simplify the manager's job, provide useful information to farmers and generate the required reports.

One of the advantages of the information society existence is speed of information flow. The modern economy is built on making effective decisions, based on information flows. For example, it is necessary to have timely information on the availability and the need for Ukrainian and foreign manufacturers in order to develop the effective functioning of agricultural machinery market. Reliable information can be obtained from official statistical sources. In Ukraine it is got electronically with a delay of 2–3 months, and in printed sources – 6–9 months. It prevents rapid response to market needs, and to some extent it may cause disruption of technology.

We can offer a strategic development plan for the information sector in agricultural production management. It will include the following steps [Kovaliv 2016]:

1. To develop and offer normative and legal support of electronic means use in Ukraine. The basic idea of the introduction is the interest of all parties of public relations to use new technologies. In our opinion, the most difficult element will be the farmer's conviction in the financial feasibility of the acquisition and use of certain software products and "gadgets". The solution of this issue can be possible by making a fundamentally new relationship between the producer and state. One must use financial leverages of influence, namely if the state is interested in collecting complete and accurate information then certain targeted support programs in rural areas should be directed only to people who use the selected software. To finance the proposed measures one can set up the fund and create Agency of Modernization of the Agriculture from the state budget (eliminating certain departments of Ministry of Agro-Industrial Complex) and foreign investments (including targeted programs on informatization of society and investors who conduct production activities in Ukraine).
2. Electronisation of all processes and objects. It is necessary to create the conditions of electronic document circulation, available electronic land cadastre, and electronic self-government and so on for the implementation of the chosen stage. Transferring all processes in an electronic form one can create the necessary management system with the opportunity of instant access to each of them. Electronization of management activities should be focused on functional problems such as multifactor planning, calculation of balance, and development of standards, accounting and control. The management bodies should be online in solving complex and large-scale information problems, for which they should receive timely, high-quality, complete and accurate information from manage-

ment objects; timely process it, and make management team, do reporting and analysis for users and information providers.

3. To introduce information systems as to types of foreign analogues. The research of programs application possibility for Ukrainian enterprises (agrivi, RolnikOn, agri360, landmark, GroMax – Contact farming), as a part of the database formation to create a system of state support and encourage the development of Agro-Industrial Complex industries, as well as the public purchases system. We can create proposals for the creation of the necessary program in Ukraine and apply it for agricultural enterprises and farmers on the basis of the study of mentioned software products. The development of the program and ways of its implementation for private peasants' farms, whose products are almost not published are very important. In Ukraine some companies, including well-known products of SAS and Agro IT, which offer products, adapted to Ukrainian reality, launched pilot projects for the creation of databases for enterprise management. However, in our opinion, these products should be improved by integrating a public information base.
4. To introduce software, process and implement state support system, adapted to the EU legislation of Ukraine, that will take into account the features, shape, territory management, types and products, state order and so on. The proposed information system is able to diversify and balance the financial resources of the state for the balanced development of all management forms, to organize the necessary base for strategic planning and current activity of enterprises. Implementation of information systems will make it possible to revive the Ukrainian market because of consumer mistrustful attitude to products of Ukrainian enterprises due to lack of control. It will allow monitoring of all phases of pork production, feed, dietary supplements, and young pigs and as a result create maps. It will be the basis of a safe Ukrainian sale and export to foreign markets. Ecologically clean products of pig farming industry can be a particular product.

According to experts, Ukraine is a powerful manufacturer of pig farming products, although Ukrainian demand depends on many factors. We think that the purchasing power of the population is the main reason. Index of real salaries in 2015 compared with 2014 amounted to 79.8%. Although in 2015 the size of the average nominal salary of full-time employees of enterprises, institutions and organizations (employing 10 persons or more) compared with the corresponding period of 2014 increased by 20.5% and amounted to 4 195 UAH (600 PLN). In 2015 expenditures of people increased by 16.9% in comparison to the previous year.

In 2015, the number of pig growing was increased by almost 0.7% (to 1 024 thousand tons), that is the second result after the record of the year of 2013 (1 047.5 thousand tons) – Table 1.

Table 1. Top-3 regions of pig growing in 2015

Specification	Growing pigs in live weight (thousand tons)	The average daily growth (g)	Heads of pigs at the end of the year (thousand heads)
Donetsk	84.7	236	558.9
Kyiv	81.7	537	585.5
Dnipropetrovsk	70.9	447	630.1

Source: Ukrainian Agrarian Confederation made a rating of livestock regions. Retrieved from: <http://agroconf.org/content/uak-sklala-reyting-tvarinnickih-regioniv> (Access: 28.09.2016).

The average rise also increased to 482 g/day, continuing positive trend in the industry. Record of the growth was achieved in Ivano-Frankivsk – 716 g/day [Ukrainian pork... 2015]. Nevertheless, market leaders in Ukraine in production of pork in live weight are Donetsk, Kyiv and Dnipropetrovsk region.

There was a surprise of the continuation in the pork growing production by 2.3% to 759.7 thousand tons. In calculating on 1 head, the production was also a record, reaching 103 kg, that is 7.3% more than in the previous year. The maximum level of this indicator among regions was reached in Zhytomyr region – 149 kg/head [Ukrainian pork... 2015]. But, market leaders in Ukraine in meat production are Donetsk, Kyiv and Dnipropetrovsk region too (Table 2).

Table 2. Top-3 regions of pork production in 2015

Specification	Meat production (thousand tons)	Heads of pigs at the beginning of the year (thousand heads)	In calculation on 1 head (kg)
Donetsk	64.5	478.8	135
Kyiv	58.6	527.7	111
Dnipropetrovsk	51.0	530.1	96

Source: Ukrainian Agrarian Confederation made a rating of livestock regions. Retrieved from: <http://agroconf.org/content/uak-sklala-reyting-tvarinnickih-regioniv> (Access: 28.09.2016).

In 2015 Ukraine conducted an active trade of pork. It was done by 12 key traders. An association of pig breeders predicted the preservation of the number of pork production in 2016 at the level of the current year – 740 thousand tons. However, this year Ukraine is losing 90% of exports because of the ban of Russia on Ukrainian products import from the first of January. According to data of the State Fiscal Service of Ukraine, our country exported 1.52 thousand tons of fresh, chilled and frozen pork (Ukrainian Classification of Goods of Foreign Economic Activity 0203) during January – August 2016. It is in 12.85 times less than the number of pork, exported abroad for the same period last year. Therefore, finding new international markets for Ukraine is urgent as ever. Ukrainian pig producers actively participate in international exhibitions and fairs which are effective means of communication policy in international marketing.

Presentation of Ukrainian products in foreign markets is a powerful engine of progress. Thus, in 2016 our producers took part in Exhibition “Food Expo 2016” in Hong Kong. This communication has brought fruitful results: Chinese traders wished to cooperate with our pork producers. But their needs are measured in huge amounts of pork. Therefore, representatives of 10 Ukrainian companies, interested in this offer, agreed to unite and work together on the Chinese market. But customers are concerned about the pork quality. The given condition can be achieved by Ukrainian producers of pig farming production only in the implementation of advanced technological solutions and strict adherence to international standards. This opportunity exists mainly in large commercial structures, industrial pig farms with the number of pigs over 5 thousand, where foreign investment can exist. On 1 August 2016, 7.55 million pigs were in Ukraine. Among them, 51% was held in the industrial sector. This year, its share is higher than in 2015, and the number shows the growth of 1.6% (61 thousand heads of pigs) [pigua.info 2016]. Today, the 30 largest pig farms hold about 60% of industrial pigs, and this share is gradually increasing. The second condition for the release of our products on the Chinese market is the certification. Ukrainian government needs to negotiate with China on the admission of Ukrainian agricultural products to their market.

Having reached its minimum in early 2016, export pork prices begin to recover. It gives an idea about trends in purchase prices on the world market. According to the 4 major exporters (the EU, the USA, Canada and Brazil), in June the average price of pork has reached 2.52 USD. It is the highest since October last year, but it is lesser than June 2015 (12 cents lower). The July prices in the USA, Canada and Brazil, the EU, exceeded last year’s figures. In North America, prices reached the highest level after the peak price in 2014, caused by Porcine Epidemic Diarrhoea. In recent weeks, they decreased slightly as supplies increased. This trend will continue.

One of the main partners and competitors is Poland. According to results of 2015 Poland belongs to Top-10 countries in all indicators of foreign relations in the Agro-Industrial Complex of Ukraine. So, for 12 months in 2015 Poland took the sixth place in the Top-10 countries as to the share of agricultural trade turnover with Ukraine with the index 4.3% (796.6 million USD). Ukraine exported agricultural products on 477.5 million USD and imported on 319.1 million USD to Poland. The balance of foreign trade in Agro-Industrial Complex between countries is positive and amounted to 158.4 million USD.

The most exported commodity goods to Poland became residues and waste from the food industry (91.7 million USD), juices (71.3 million USD), materials of vegetable origin (54.8 million USD), oil (45.5 million USD), oilseeds (53 million USD). The main items of imports of Polish agricultural products to Ukraine are meat

and by-products (45.7 million USD), the skin of cattle, sheep and lambs (36.7 million USD), residues and waste from the food industry (32 million USD), processed vegetables and fruits (27.8 million USD), fruit, nuts and peel (24.8 million USD). [Pavlenko 2016].

Thus, among the threats to the European integration of the Ukrainian pig farming there are real and potential factors:

- the low purchasing power of citizens of Ukraine, which limits Ukrainian demand and, in addition, it significantly reduced for the last time, which in itself encourages producers and processors to enhance export effort;
- introduction of new technologies will help to speed up the certification of products;
- high degree of influence of biological factors when working with animals, growing unpredictability and risk of doing business;
- the cyclical nature of the industry in the limited demand;
- unstable economic situation in the first place, fluctuations in product prices and the resources of the national currency increase the risk, reduce the predictability of the market, the investment attractiveness of the industry;
- deepening disparity in prices between industry, processing industry and agriculture (equipment, feed additives, fuel energy etc.);
- the rising of financial resources cost reduces investment enthusiasm of Ukrainian shareholders in attracting credit funds for expansion, modernization of the industry;
- the inactivity of state policy to harmonize the conditions of cooperation with foreign partners, which are able to slow down the integration process significantly;
- loss of Ukrainian market, crowding out Ukrainian enterprises due to increased competition from foreign companies [Koberniuk 2015].

SUMMARY AND CONCLUSIONS

Ukrainian products of high levels of quality, being popular in more than 190 countries have significant export potential on neighboring European markets. We need the best practices, experience of the development of the EU market and we are ready to implement them. Our western neighbor and reliable partner Poland proved its right to the title of full member of the European family of nations, and the experience of this country is precisely a model of successful integration, which will help Ukrainian agricultural sector to explore its opportunities to the full.

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COSTS OF COMPLIANCE OF PIG FARMS IN POLAND AND SELECTED EU COUNTRIES WITH THE EU ANIMAL WELFARE AND FOOD SAFETY LEGISLATION

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Abstract. The paper presents the estimates of potential impacts of changes in the EU legislation regarding animal welfare standards and food safety regulations on costs of production in the pig sector in Poland, the Netherlands, Denmark and Germany. Basing on the InterPIG cost models using the typical farm approach, the study confirmed considerable differences between the analysed countries in terms of scale of production and productivity. The results clearly show that legislation in the fields of the animal welfare and food safety moderately increases costs of pig production. The most significant increases were observed in Poland (8.3%) and in Germany (4.3%), where the size of an average farm is much smaller than in other studied EU countries.

Key words: pig production, costs of compliance, EU regulations, animal welfare, food safety

INTRODUCTION

Socio-economic evolution of markets and associated governance have progressively explored the possibilities of increasing animal productivity. With existing knowledge, techniques and technologies, the process of intensification and concentration of animal production is continuing [Mench 2008]. An intensification in animal production has risen up the public debate and growing political and social interest, which in consequence has resulted in increased policy attention [Harvey et al. 2013]. A number of legislations have been introduced in late eighties and nineties of the 20th century in the European Union, regulating provision of safe food by animal-welfare friendly production systems. From an economic theory perspective, legislation guarantees the provision of a series of “goods” at a publicly accepted level [DG-AGRI 2014]. Most of these goods, i.e. animal welfare and health, food safety, are non-tradable and hard to privatize. The resulting excesses and shortages are considered as negative externalities since they have a potentially negative impact on parties

not directly involved in agricultural production [Glebe 2007, van Huylenbroeck et al. 2007]. However restrictive regulations in the fields of animal welfare and food safety have the potential to generate a cost increase at the farm level, that result with reduced farm incomes [Gębska et al. 2012]. At the level of European agriculture introducing more restrictive law regulations may even undermine global competitiveness of the sector. Legislation influences both the production process and farm management. The resulting changes in the farmer's production function(s) can have an effect on the output(s), and, together with a change in input prices, they have the potential to influence the profit function. In other economic sectors, producers are likely to translate higher input costs into higher output prices to the consumer. This is however often difficult for farmers, as they are price-takers for most agricultural products [Brouwer et al. 2011]. Farming sector is characterized by a large number of suppliers (farmers) who face a limited number of buyers. In these types of markets farmers do not have the power to transfer an increase of production costs due to compliance with legislation into higher prices.

Legislation can affect the agricultural business directly and/or indirectly through other supply chain actors such as animal transportation (i.e. in the case of legislation on animal welfare) or food processing and feed mills (i.e. in the case of legislation on food safety). In fact, stricter regulations affect the upstream or downstream nodes of the supply network, and they might transfer these extra costs to the farmers [Brouwer et al. 2011].

The paper attempts to present comparative assessment of farm level impacts of compliance with legislation in the fields of the animal welfare and food safety in the pig sector¹. Results of calculations were presented in details for the Polish typical farm and then confronted with selected European countries – Germany, Denmark and the Netherlands.

METHODS

Selected legislation

The set of animal welfare standards (e.g. housing systems; space allowances; minimum roughage levels in feed) and food safety regulations (e.g. identification and registration of animals; implementation of food traceability systems; prohibition of

¹ The study was prepared under the EU Commission Evaluation Project, "Assessing farmers' cost of compliance with EU legislation in the fields of environment, animal welfare and food safety". Final EC Report, AGRI-2011-EVAL-08 [2014].

hormones) has been selected in collaboration with experts for analyses of costs of compliance with the EU legislation in these fields. The list of 11 directives and regulations that introduce relevant standards is presented in the Table 1.

Table 1. List of regulations chosen for analysis

Area of regulation	Selected legislation
Animal welfare	Directive on protection of pigs (2008/120/EC)
FS1	Directive on undesirable substances in animal feed (2002/32/EC) Directive on medicated feedstuff (90/167/EEC) Regulation on feed hygiene (183/2005) Regulation on additives for use in animal nutrition (1831/2003) Regulation on placing on the market and use of feed (767/2009)
FS2	Directive on control of foot-and-mouth disease (2001/89/EC) Directive on control of classical swine fever (2003/85/EC) Directive on control of swine vesicular disease (92/119/EEC) Directive on zoonotic agents (2003/99/EC)
FS3	Directive on prohibition of hormonal substances (96/22/EC)

Source: own study.

Specifically, “animal welfare” (AW) refers to the Directive 133 2008/120/EC on the protection of pigs. “Food safety” (FS) is sub-clustered into three groups which cover aspects connected to feed mills and the production of animal feed, the prevention and control of diseases, and the prohibition of hormonal substances.

Regulations relevant to the feed industry were included to consider indirect effects on farmers such as for example higher feed prices.

The reference year and data sources

The year 2010 was established as the reference year for the study. All cost calculations presented in the paper are related to this year and refer to legislation introduced in the past, including legislation issued, but not yet implemented in 2010 (e.g. the animal welfare legislation for pigs issued before, but enforced after 2010).

InterPIG network was used as data source for this study in order to calculate the costs of production and express them in EUR per weight unit (kg, tons) of product. The costs of production calculated for the reference year 2010 were a basis for constructing the “base”. Compliance costs were subtracted from total production costs in base scenario, when the regulation was implemented in the past (before 2010). In this case, the calculated production costs are named “without regulation” (if the legislation was not in place). Compliance costs were added to production costs of the base scenario, when the farmer still needs to adjust to regulations in the near future in order to comply with the legislation. In this case calculated production costs are called “with regulation”.

Typical farm structure approach

For the costs estimations we based on the “typical farm” approach. A typical farm is a model farm representing the most common farm type for a specific product in a specific country or region. The necessary technical and economic data to define a typical farm were collected by local experts from real farms. Four Member States with different pig production characteristics were chosen for the analysis: Poland, Germany, the Netherlands and Denmark. These countries represent 44% of the total EU-27 pig population.

A brief description of the typical pig farms included in the analysis of the costs of compliance is provided below.

PL50 is a typical, small, family farm with 50 sows and producing yearly 1 070 fatteners. The productivity of this closed cycle pig farm is the lowest of the other EU typical farms analysed in this study as it averaged 22.07 piglets per sow in 2010. The number of pigs born per litter is particularly low (10.51) and the relatively low number of litters (2.1) per sow annually reduces the overall sow productivity.

DK614 is a pig farm with 614 sows and 6 514 fatteners. This pig farm produces 1 286 kg of lean meat per sow. The average live weight at slaughter is 107 kg. The Danish sow herds are the most productive in the EU with 28 piglets weaned per sow annually. This high productivity is achieved due to the high number of litters per sow (2.26) and the high number of piglets born alive per litter (14.50).

DE187 with 187 sows represents relatively smaller German pig farms. The lean meat production of this farm is 1 238 kg per sow. The average live weight at slaughter is 120 kg. The productivity of the sow herd is of 24.8 piglets weaned per sow. With an average daily gain of 754 g per day, the performance of the fattening activity is rather modest in comparison to the Danish and Dutch pig farms.

NL369 can be considered the typical, average size Dutch pig with 369 sows and 9 786 pigs sold per year (369×26.52). This farm produces 891 504 kg of pork (cold weight).

Key variables of the pig herd and costs of production

Significant differences are detectable between the countries analysed in terms of pig farm size and levels of productivity. Denmark is characterized by big sow herds with very high levels of productivity, allowing for the production of low priced piglets which are mainly exported to other EU Member States. This high productivity is achieved mainly due to genetic improvements and high farm management standards. The live weight at slaughter for Danish pigs is quite low as an important export market is the UK, which demands light cuts of pork.

The Netherlands follow Denmark in productivity but the pig farms size is a little smaller. Number of pigs sold per sow is even higher (26.52) than in Denmark (26.24). The country is a renowned exporter of pigs and pork meat, highly competitive on the EU market.

German pig farms are smaller on average, mainly family-owned farms with rather modest productivity level. Germany is increasingly importing piglets from abroad, especially from Denmark (about 60%) and the Netherlands (about 40%). Pigs are slaughtered at a higher weight than other EU Member States due to the requirements of the processing industry.

In Poland pig farms are predominantly small, family-owned businesses, although a few very large holdings also operate. The typical Polish farm raises about 50 sows and fattens their pigs on the same site. The technical consequence of this structural condition is that the pig farms lag behind other EU Member States in terms of technical efficiency and labour productivity.

Table 2. Key variables of the typical pig farms in the selected EU countries in 2010

Specification	DK614	DE187	NL369	PL50
Farm size (units of sows)	614	187	369	50
Farm size (units of fattening pigs) ^a	1 462	1 000	1 422	350
Animals' origin	own animals	own animals	own animals	own animals
Legal form	agribusiness farm	family farm	family farm	family farm
Average days in rearing unit (days)	54	51	50	49
Rearing daily live weight gain (g/day)	450	440	365	407
Rearing feed – conversion ratio	1.73	1.68	1.55	1.75
Empty rearing unit days per cycle	5	5	5	5
Pigs per pig place per year – rearing	6.23	6.53	6.65	6.71
Average days in finishing unit (days)	85	120	114	107
Average daily gain in finishing (g/day)	895	754	799	847
Finishing feed-conversion ratio	2.68	2.87	2.63	2.94
Empty finishing unit days per cycle	7	7	7	7
Pigs per pig place per year – finishing	3.95	2.88	3.01	3.21
Average live weight at slaughter (kg)	107.8	120.3	116.4	117
Average lean meat (%)	60.2	56.7	56.5	56.7
Total land (ha)	210 ^b	60	5	30

^a pig places/average pigs on farm, ^b based on average farmland owned or rented and compared to animal unit in the InterPIG database; not including land for buildings

Source: for Poland – own calculation based on InterPIG, for other countries – EC Report AGRI-2011-EVAL-08 [2014].

Table 2 presents a selection of key variables describing pig herds and production systems in the selected countries. Table 3 presents an overview of the total cost of production.

Table 3. Costs of production for pig in selected countries in 2010

Specification	Unit	DK614	DE187	NL369	PL50
Land cost	EUR 100 kg SW	0.11	11.00	0.36	4.55
Labor cost	EUR 100 kg SW	14.56	14.12	14.50	10.12
Capital cost	EUR 100 kg SW	24.44	26.86	22.89	13.86
Non-factor cost	EUR 100 kg SW	100.05	100.78	104.55	97.13
Total cost	EUR 100 kg SW	139.16	152.76	142.3	125.66
Pig price	EUR 100 kg SW	126.80	145.00	130.46	127.99
Price – cost ratio	–	0.91	0.95	0.92	1.02

SW – hot slaughter weight

Source: own calculation based on InterPIG database.

The differences in production costs between the countries are significant – the lowest in Poland mainly due to low costs of labor and capital, noticeably higher in other countries (Table 4). In Germany costs are the highest, which is, regardless the high technical productivity of the pig herd, resulting from extraordinary land cost. Also prices of pig meat differ between the countries. Price to cost ratio indicates that in Germany, the Netherlands and Denmark costs exceeded revenues. Poland was an exception with the ratio above one.

Differences in production costs (Table 3) may be largely explained by a number of parameters presented in Tables 2 and 4.

Table 4. Drivers of production cost differences by country in 2010

Cost item	Denmark	Germany	Netherlands	Poland
Labor (EUR/h)	21.90	15.70	30.00	5.00
Average compound feed price for finishing pigs (EUR/ton)	201.08	199.60	223.50	200.00
Maize price (EUR/ton)	159.50 ^a	195.33	197.32	195.00

^a based on price of wheat (147.7 EUR/ton wheat) and multiplied by 1.08 (MJ maize/kg/MJ wheat/kg)
Source: InterPIG 2010, Landwirtschaftskammer Niedersachsen 2010, Landwirtschaftskammer Nordrhein-Westfalen 2010.

COSTS OF COMPLIANCE WITH SELECTED LEGISLATION – RESULTS FOR POLAND

Animal welfare legislation

The Directive on the protection of pigs imposes that farmers assures that animals have enough space for movement, provides a minimum of surface for gilts, sows and fattening pigs. Stables should also be structured in compliance with the requirements regarding noise levels, ventilation and light as well as an appropriate quality of floors. Moreover, the Directive bans the use of tethers for sows and gilts, which have to be housed in groups during a period starting from four weeks after service to one week before farrowing. The Directive sets further limitations on the practices of tail docking and the reduction of corner teeth. Finally, sufficient quantity of high-fibre food must be assured for sows and gilts.

Two alternative scenarios for meeting the requirement of space allowance increase were studied:

1. *Scenario A.* Reduction of the number of fattening pigs and sows to the level allowing for compliance with the space allowance requirement. We estimated that, in order to fulfil the new space requirements, a typical farm has to reduce the number of sows by 15% and number of fatteners by 5.8%.
2. *Scenario B.* Enlargement of buildings for sows and fattening pigs allowing maintaining the same number of animals with adequate investments in buildings and equipment.

Other costs estimated within both scenarios were: investments in flooring and group housing; use of manipulable materials; of high-fibre feed. We considered also cost of additional feed compensating a loss of energy due to greater freedom of movement as a consequence of providing more space for animals.

Calculations, which are based on the InterPIG model, were made for a farm with the full cycle (sows and fatteners). This type of pig farms is still dominant in Poland. The base scenario for 2010 does not include the costs of adjustment to the Protection of Pigs Directive, which in Poland in 2010 was not fully obligatory, due to transition period for its implementation for all the pig farms till the end of the year 2012. We consider that typical pig farm still have to adapt to animal welfare requirements in 2010, thus base costs were considered as “without regulation”. The results are presented in Table 5.

Investment in building to sustain the level of production is a more profitable solution than the reduction of the number of pigs. Additional cost (depreciation and interest) of investment is about 0.98 EUR/100 kg of slaughter weight (at 2010 price to costs ratio), whereas reduction of production of meat by 15% increases the costs of production by 2.5 EUR/100 kg due to existing fixed costs being divided by a lower number of units of production.

Table 5. Impacts of selected changes in pig production on costs of production due to animal welfare legislation in Poland

Change	Base scenario 2010 (without regulation)	With regulation	Difference	
			EUR/100 kg SW	base = 100%
Reduction of number of pigs	125.66	128.20	2.54	102.02
Investment in building to sustain the level of production		126.64	0.98	100.78
Investment in adjustment for group housing and flooring		126.60	0.94	100.75
Use of manipulable materials		126.64	0.99	100.78
Increased use of feed (5% sows, 10% fatteners)		126.28	0.62	100.49
Reduction of VET costs		125.66	0.00	100.00
Using high fibre feed		126.78	1.12	100.89

SW – hot slaughter weight

Source: own calculations based on InterPIG database.

Investment in group housing and flooring is relatively cheap in Poland, in comparison to other countries, and amounts to about 190 EUR per sow (including the group feeding). The average costs after adjustment would increase by 0.94 EUR/100 kg of slaughter weight.

It was assumed that the increase of space allowance for fatteners and sows worsens the feed conversion ratio. According to the opinion of our experts, pigs having more space are more active, but also to a lesser extent warm up each other. Thus it was estimated that the average feed consumption increases by 5% for sows and 10% for fatteners. This increases the costs by 0.6 EUR/100 kg of hot slaughter weight.

The requirement to provide manipulable materials for pigs increases cost of production by 0.99 EUR/100 kg (Table 5). Traditionally straw used for bedding was considered as a manipulable material in Poland. However, because of a switch to slatted floors the use of straw in typical pig farms was significantly reduced. Nowadays, the most popular materials used to comply with the Directive are wooden sticks, chains (one per box) and plastic bottles (3–4 per box).

We have also discussed with the experts what might be a likely impact of implementing the Directive on veterinary costs. Both the experts and interviewed farmers are rather sceptical regarding potential reduction of veterinary interventions. Due to improved animal welfare, some savings on vet costs might be expected as an effect of provision of manipulable materials or improved flooring. However, according to the expert's opinion, group housing of sows may cause more injuries to piglets by walking sows, and injuries to sows because of their more aggressive behavior in

a process of setting up a hierarchy in the group. Thus the balance on the vet costs was estimated at zero.

Costs of usage of high fibre feed for sows and gilts was additionally presented in Table 5. In Poland the content of high fibre components in the feed for pigs is traditionally high. This is because the vast majority of farmers prepare the feed on farm mixing their own grains (often with addition of bran and dried fodder) with purchased high protein concentrates. We may assume that only a small number of farms would need to change the feeding practice due to the regulation (approx. 10%). The additional costs related to this change are presented in Table 6.

Table 6. Impacts of selected changes in pig production on costs of production due to animal welfare legislation in Poland under different scenarios

Change	Base scenario (without legislation)	Scenario A: reduction of number of pigs	Scenario B: enlargement of buildings	Scenario C: 50% A and 50% B
Investment in adjustment for group housing and flooring	125.66	0.942	0.942	0.942
Investment in building to sustain the level of production		×	0.977	0.5*0.977
Reduction of number of pigs		2.538	×	0.5*2.538
Adding manipulable materials		0.978	0.978	0.978
Increased use of feed (5% sows, 10% fatteners)		0.617	0.617	0.617
Reduction of VET costs		0	0	0
Using high fibre feed		1.12	1.12	1.12
Total cost increase (EUR/100 kg SW)		×	6.19	4.63
Total cost (EUR/100 kg SW)	125.66	131.85	130.29	131.07
% Increase		4,93	3,68	4,3

Source: own calculation based on InterPIG database.

In Table 6 the total cumulative costs of implementing the Animal Welfare Directive for pigs are presented. Costs were calculated for both scenarios (A and B) and scenario C, as an average, assuming that 50% of farmers will invest in buildings (A) and another 50% will decide to reduce number of pigs.

In the cheapest scenario (B), where investment in the building was estimated to sustain the current production level the implementation of the Directive would increase the costs by 4.63 EUR/100 kg of hot slaughter weight. However, most likely not all farmers will have a potential to enlarge size of buildings for pigs and will reduce the number of pigs. This will result in an increase of costs by 6.19 EUR/100 kg slaughter weight. On average an estimated cost of implementing the Directive, considering that each of the scenarios A and B is introduced by 50% of pig farmers, an estimate for the cost increase is 5.41 EUR/100 kg (scenario C).

Legislation concerning food safety

There are three groups of food safety and animal health laws considered in the study. The group Food Safety 1 applies to Denmark, Germany, and Poland, and includes five directives and regulations which directly affect feed mills. Compliance with the food safety regulations in the feed mill industry results with higher costs transmitted further to feed prices paid by farmers. The group Food Safety 2 applies to all countries and includes four directives dealing with the prevention of diseases: classical swine fever, foot-and-mouth disease, swine vesicular disease, and zoonoses. Fulfilling the requirements of the regulations in this area generates additional prevention costs, such as obligatory vaccinations, analyses of samples, administration and veterinary activities.

The group Food Safety 3 introduces the ban on the use of hormonal substances and the use of beta-antagonists, including in the EU ban on the use of ractopamine, a growth promoter, which is allowed in the other parts of the world, i.e. the USA.

Food Safety 1

The country experts contacted a group of feed mills in Poland and investigated the costs related to the compliance with the respective legislation. The results of the Feed Mills Survey show that prices of the compound feed should be increased by 5% compared to the base year. Answers to this question ranged between 0% to up to 15%. The impact of the changes imposed by the regulations related to feed production is presented in Table 7.

Table 7. Costs of compliance with Food Safety 1 legislation in Poland (EUR/100 kg SW)

Change	Base (with regulation)	Without regulation	Difference	
			EUR/100 kg SW	base = 100
Change of production costs due to change in price of feed change	125.66	121.35	4.31	96.57

Source: own calculation based on InterPIG database.

Food Safety 2

A second group of regulations concerns the prevention of diseases on the farm. This implies costs on the farm related to measures to improve bio-security. Livestock farms have invested in bio-security fences and gates, special clothes and shoe covers for visitors, truck baths, quarantine facilities and on the correct disposal of dead animals. This group includes directives on the prevention of foot-and-mouth dis-

ease; swine vesicular disease; bluetongue; classical swine fever; avian influenza; Newcastle disease; monitoring of zoonoses and zoonotic agents, and control of salmonella. Another requirement deals with disposal of dead animals which, however, does not generate any costs for farmers. Dead animal disposal is financed by the government in Poland.

In case of vaccination of pigs against diseases, these costs were not taken into account because prevention measures were already introduced to the national legislation, before publication of Food Safety 2 directives considered in this study. The cost components and their impact on the production costs are presented in Table 8.

Table 8. Impacts of selected changes in pig production on costs of production due to Food Safety 2 legislation in Poland (EUR/100 kg SW)

Change	Base (with regulation)	Without regulation	Difference	
			EUR/100 kg SW	base = 100
Investment in truck baths at farm entrance and clothes and shoe covers for visitors	125.66	124.57	1.087	99.13
Disposal of dead animals		125.66	0	100.00
Total	125.66	124.57	1.087	99.13

Source: own calculation based on InterPIG database.

Food Safety 3

Council Directive 96/22/EC prohibits in livestock farming the use of substances having a hormonal or thyrostatic action and of beta-agonists. The prohibition to use these substances lowers the Feed Conversion Rate of fattened animals which in practice means a lower meat production with the same use of feed on the farm. In Poland use of ractopamine was prohibited already before entering the EU, therefore implementation of EU regulations in this area did not change the average costs of production.

Synthesis of costs of compliance in pig production in Poland

Implementation of the Directive on the protection of pigs (animal welfare) will generate an increase of the production costs by 3.7% up to 4.9% depending on the scenario. The lowest cost increase was observed in case of scenario B, assuming enlargement of buildings for sows and fattening pigs allowing to maintain the same number of animals with adequate investments in buildings and equipment (by 3.7%).

The adjustment of the feed mills to the Food Safety 1 regulations has created for Polish pig farms a significant burden which has created an increase in production cost by 3.55%. It was mainly due to the increase of feed prices estimated on average for 5%.

The Food Safety 2 legislation impact was estimated for 0.87% increase of costs. Costs of obligatory vaccination of sows and piglets constituted the largest share in this increase, and additional costs were related to installation of track baths and purchases of special clothes and shoe covers for visitors.

Table 9. Summary of costs of compliance with selected legislation in pig production in Poland

Poland	Unit	Animal welfare (B)		Food safety	
		with	without	with	without
Total costs	EUR/100 kg SW	130.29	125.66	125.66	120.27
Change of production costs	%	–	–3.56	–	–4.29
Total revenues (pork meat price)	EUR/100 kg SW	127.99	127.99	127.99	127.99

Source: own calculation based on InterPIG database.

After implementing all the EU regulations considered in this study the average costs of pig meat production in Poland increase by 8.33% (by 10.02 EUR per 100 kg of hot slaughter weight).

INTERNATIONAL COMPARISON OF COMPLIANCE COSTS

Regarding animal welfare legislation, all EU Member States included in this study are suffering an increase in production costs related to the implementation of animal welfare regulations. The changeover to group housing of sows, the renovation of the floors, the introduction of enrichment material and low fiber feed have a relevant impact on the production costs in the EU Member States. The cost increase is particularly significant in Poland (+3.56%) as the pig farms are relatively small with respect to the size common to the other three EU Member States. In Denmark the impact on costs is limited, as Danish legislation had already provided similar requirements years ago and relevant upgrades of facilities have been already made. With regards to manipulable materials, the requirement applies to the Netherlands, yet the relative costs of compliance are negligible.

Table 10. Costs of compliance with animal welfare legislation for pigs in selected countries

Food safety		Unit	Base (with regulation)	Without regulation	Difference	% change
Denmark	DK614	EUR/100 kg SW	139.16	138.25	0.91	0.65
Germany	DE187	EUR/100 kg SW	152.76	149.44	3.32	2.17
Netherlands	NL369	EUR/100 kg SW	142.30	139.55	2.75	1.93
Poland	PL50	EUR/100 kg SW	125.66	125.66	4.63	3.56

Source: own calculation and EC Report AGRI-2011-EVAL-08 [2014]

Food safety legislation has a strong cost impact on the Polish pig farms. Most of the compliance costs are faced by the feed mills which transmit these compliance costs in the form of higher feed prices (+5%) to Polish pig farmers. A relevant increase of feed prices followed the compliance of the feed mills with EU legislation in the other EU countries as well. The regulations concerning the prevention of diseases have a much lower impact on production costs. Disease prevention regulations do not generally cause extra costs in Poland, because investments to comply with comparable standards were mostly implemented in response to national legislation antecedent to EU norms. Such costs are estimated to amount to 2.5 EUR per piglet and 15 EUR per sow.

Table 11. Costs of compliance with food safety legislation for pigs in selected countries

Food safety		Unit	Base (with regulation)	Without regulation	Difference	% change
Denmark	DK614	EUR/100 kg SW	139.16	137.04	2.12	1.52
Germany	DE187	EUR/100 kg SW	152.76	149.84	2.92	1.91
Netherlands	NL369	EUR/100 kg SW	142.30	142.01	0.29	0.20
Poland	PL50	EUR/100 kg SW	125.66	120.27	5.39	4.29

Source: own calculation and EC Report AGRI-2011-EVAL-08 [2014].

The discussion above is reflected and summarized in Figure 1, which depicts an overview of the magnitude of the total costs of compliance with respect to total production costs.

Costs of compliance are relatively high for Poland, largely because some regulations have been implemented in Denmark, Germany and the Netherlands before making changes in the EU laws but also for the reason of a small scale of pig production in Poland and its lower efficiency than in the other countries.

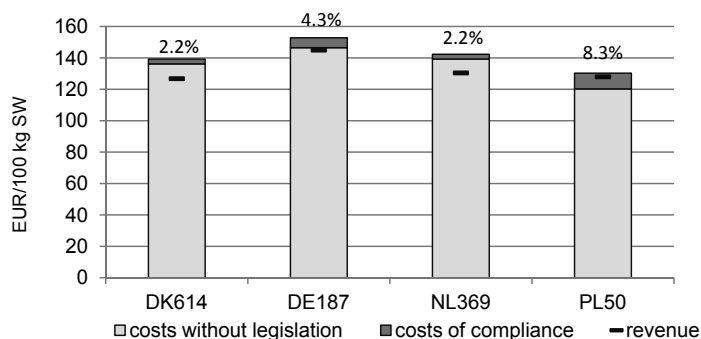


Figure 1. Pig meat production costs at typical farms in selected countries with and without legislation
Source: own calculation based on the InterPIG data base and EC Report AGRI-2011-EVAL-08 [2014].

CONCLUSIONS

The analysis based on the typical farm approach does not allow to draw statistically significant conclusions, but gives a fairly convincing estimates of potential impacts of changes in the EU legislation regarding animal welfare standards and food safety regulations on costs of production in the pig sector.

Considerable differences were found between the analysed countries in terms of scale of production and productivity. Denmark is characterized by large, highly productive sow herds, allowing for the production of low priced piglets which are mainly exported to other EU Member States. Herds of pigs in German and Dutch farms are smaller, but productivity in the pig sector is similar to that in Denmark. On the contrary, a typical Polish farm raises about 50 sows and is lagging behind in terms of technical efficiency and labour productivity.

Within the EU, however, Poland has relatively lower production costs, mainly owing to the low cost of labour and capital. The production costs are the highest in Denmark because, regardless the high technical productivity of the pig herd, labor costs on Danish farms are very high.

The results clearly show that legislation in the fields of the animal welfare and food safety moderately increases costs of pig production. The most significant increases were observed in Poland (8.3%) and in Germany (4.3%), where the size of an average farm is much smaller than in other studied EU countries – Denmark and the Netherlands.

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CHANGING STRUCTURE IN THE U.S. HOG SUPPLY CHAIN: IMPLICATIONS FOR MARKET PRICE DISCOVERY

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Abstract. The United States hog supply chain has undergone considerable change during the past 20 years. The structure of the industry has changed considerably with greater focus on branded pork meat products at retail, new management strategies of hog production, changes in the size of the hog, and changes in improving meat further processing and packaging. These structural changes have changed the methods of marketing used by hog producers, hog processors, and pork meat buyers. During the past 20 years, there has been rapid adoption of marketing and production contracts to coordinate supplies. The percentage of both the hog and pork meat markets utilizing negotiations to discover price has dropped accordingly. Persons representing the U.S. hog supply chain are now in the process of understanding and analyzing alternative price discovery options to the negotiated cash trade. We share here the trends in the U.S. hog market during the past 20 years to allow readers to understand how quickly structural change has occurred and implications of the changes.

Key words: hogs, marketing, structural change

INTRODUCTION

During the past 20 years, the methods of commerce used by the U.S. hog industry and the hog industry's structure have changed considerably. These changes have had a profound impact on the efficiency of moving pork originating in the U.S. around the world. The U.S. hog industry is a good example of an industry that was at one time fragmented at production and processing but today is an industry highly coordinated and, in certain supply chain stages, concentrated. Technological innovation, genetic selection, and more consumer discretionary income has enabled the hog industry to realize scalability (i.e. economy of size), coordination of quality, and value-added product opportunities.

One concern in the U.S. hog industry is the rapidly increased use of alternative marketing arrangements as a substitute for cash market transactions. This concerns

many in the hog supply chain because the cash market is the primary means of price discovery and is an important source for price information and settlement of the CME Group Lean Hog Futures contract. To understand how the U.S. evolved to this point, one must understand change in industry structure, which this article addresses later.

An important aspect of hog and pork meat markets in the United States is the access to price-transition data. To monitor buy – sell transactions in the livestock and meat industries, government regulations require hog processors to share private party transactions and attributes of the transactions. Attributes include animal and meat characteristics along with timing, price, and quantity. The Livestock Mandatory Reporting (LMR) Act of 1999 became law in 2001 following the call by some livestock industry participants for increased transparency in hog, fed cattle, lamb, boxed beef, and carcass and boxed lamb transactions. In 2012, wholesale pork was added as a mandatory reported product under the LMR Act. The Agricultural Marketing Service (AMS) of the United States Department of Agriculture oversees implementing and carrying out the secure collection of processor data and aggregating data into reports that mask confidential information. Many industry participants refer to LMR as mandatory price reporting (MPR). Aggregated information is reported and is publically available at <https://www.ams.usda.gov/rules-regulations/mmr/lmr> and <https://www.ams.usda.gov/market-news/swine-direct-reports> (see both National and Regional Slaughter reports).

Hog producers supported the LMR Act because it was to be a reflection of how well a producer was marketing compared to the overall market. However, 15 years after the Act was established, the price data is the primary source for hog and pork meat price discovery. The U.S. pork supply chain continues to evolve. Supply chain evolution presents challenges and opportunities. Integration and coordination of the pork supply chain continues as suppliers and processors strive to meet consumer demand for consistent, high-quality pork products. Hog producers respond to market signals by adopting pork genetics, production systems, and marketing arrangements that maximize profits¹. Likewise, hog processors adopt processing technologies, innovate into value-added products, and develop buying programs that facilitate profitable operations.

This paper studies trends in the U.S. hog market from the past 20 years. By analyzing those trends and presenting their supporting data, the research aims to allow readers to understand how quickly structural change has occurred. Plus, readers can

¹ While profit maximization is a financial goal of a business, economists find other reasons why farmers use or choose not to use marketing arrangements and production contracts, for examples see the various works of Nigel Key.

consider the implications of such structural change on the U.S. hog market and pork value chain stakeholders. In particular, this paper highlights the importance of public price reporting in facilitating trade and market efficiency. However, it addresses that industry-wide structural change may challenge the current price reporting system and contribute to industry stakeholders pursuing alternative operational structures.

DATA AND METHODS

To understand changes in the U.S. swine marketing system, this paper references data from the Grain Inspection, Packers & Stockyards Administration; USDA National Agricultural Statistics Service; USDA Economic Research Service; USDA Agricultural Marketing Service; and a host of peer-reviewed journal articles that add perspective to the industry's structural changes and reasons prompting those changes.

Evaluating data points for hog industry output, producers participating in the value chain, processors engaging in the value chain, consolidation patterns, hog slaughter, pork production, carcass weight, slaughter capacity, slaughter plant utilization, pricing choices, marketing arrangements used and consumer preferences enables readers to understand the evolution of the U.S. swine marketing system, structural change in livestock production, structural change in livestock packers and meat processors, changes in how hogs are marketed and the extent to which product proliferation has occurred. Ultimately, the changes described here have several implications for U.S. hog and pork meat pricing and the arrangements that organizations in the supply chain use to market their products.

STATE OF THE U.S. SWINE MARKETING SYSTEM

The U.S. swine marketing system has experienced significant change in recent years. While U.S. pork production increased more than 30% between 2000 and 2015, the number of hog producers declined by 23%, the number of processors dropped by 16%, and exports increased by 267% (Table 1). The U.S. hog industry has expanded production considerably, even as it's lost hog producers. It is easy to conclude that the average U.S. hog farm has grown in size. Most of these farms produce commodity hogs for processing by a handful of firms that distribute pork products to many retail establishments. The pork meat processing four-firm concentration ratio is more than 70%².

² The number is computed from data compiled by Meyer [2016].

Table 1. Snapshot of the U.S. Swine Marketing System (2000 and 2015)

Specification	2000	2015
Metric Tons Produced Domestically (ERS)	8 642 922	11 116 742
Retail equivalent value (ERS)	n/a	73B USD
Number of U.S. Producers (NASS)	86 360	63 246
Number of U.S. Processors (GIPSA)	186	157
U.S. Per Capita Consumption, Pounds per Capita (ERS)	51.2	49.8
Percent of U.S. Exports to U.S. Domestic Meat Production (ERS)	7%	20%
Percent of U.S. Imports to U.S. Domestic Meat Production (ERS)	5%	4%
U.S. Supermarket Stores (2013, FMI)	← 37 000 →	
U.S. Restaurants (National Restaurant Association)	← 1M+ →	

Source: GIPSA 2012, USDA Economic Research Service, USDA National Agricultural Statistics Service; Food Marketing Institute, National Restaurant Association.

STRUCTURAL CHANGE IN LIVESTOCK PRODUCTION

Structural change at the farm level has been well documented [Jones 2004, Key and McBride 2007, McGrann 2007, Taylor 2007, Parcell et al. 2009, O'Donoghue et al. 2011, Parcell and Schroeder 2014], and the data [Ball et al. 2016, Hoppe and Newton 2016, Key 2016] corroborate these findings. The velocity of structural change is not expected to slow. And, these trends have given rise to competing supply chains in the livestock and meat industry that are similar to supply chains in other highly concentrated industries [Woolverton and Parcell 2008].

In 2012, 15% of U.S. hog operations accounted for nearly 60% of the value of production (Table 2). The balance of the farms, nearly 50 thousand, accounted for around 40% of the value of production. We suspect the value of production by the largest producers increased well beyond 60% by 2016. Only recently have two distinct supply chain models developed in response to production consolidation.

Table 2. Hog and pig farms by type owner

Specification	% of operations	% of sales
Family/Individual	83	41
Corporation	8	34
Partnership	7	23
Other	2	2
All	100	100

Source: USDA NASS, 2012 Census of Agriculture.

Competing supply chain models have been the cause for the diverse hog production systems typical in 2016 that result in divergent use and user preferences for price information. The primary supply chain model is commodity focused realizing economies of size where bigger, and fewer, operations continue to get larger. In this

system, processors add value to base meat commodity products. The supply chain model with the greatest growing consumer interest is referred to as a value chain system where producers produce a specific trait, or set of traits, targeting a specific consumer group. In this system the identity of the highly valued traits is preserved from producer to consumer.

The economies of size supply chain has characteristics at the production level of: 1 – continued growth, focused on revenues; 2 – traditional (local) financing no longer sufficient to serve financial needs; 3 – increased need to manage the “profit margin” and “revenue risk” through contracting inputs and outputs; 4 – increased capacity to access and analyze information and translate information for decision making; 5 – emphasize genetics to deliver a more quality consistent commodity [Martinez and Zering 2004]; 6 – increased coordination between supply chain segments to respond to consumer preferences and coordinates supplies; and 7 – increased incentive to vertically integrate to better leverage information, management, and volume.

The value chain system has characteristics at the production level of: 1 – smaller size focused on trading technology for labor; 2 – greater profit margin potential, higher costs, and more production and financial risk; 3 – coordinated value chain to preserve quality characteristic identity; 4 – served by specialized processors able to maintain quality identity; 5 – increased coordination between supply chain segments to secure flow of payments from retailers and quality from producers; and 6 – specific genetics to deliver necessary characteristics or enable a specific production system.

Both production systems, for different reasons, have evolved in their need for public information. Producers, regardless of operation size, are seeking better access to information that resides closer to the consumer and end-product that they are ultimately selling. For example, hog producers have shown interest investing in, through collective action, hog processing. This will help these producers know more about processing yields, fabrication costs, and wholesale meat prices. Four such farmer-investor plants are scheduled to begin processing hogs in the next eighteen months, contributing up to an additional slaughter capacity of 29 thousand heads per day.

STRUCTURAL CHANGE IN LIVESTOCK PACKERS AND MEAT PROCESSORS

Similar to studies of structural change at the farm level, considerable research has been conducted on structural change between the farm level and consumers [MacDonald et al. 2000, Ollinger et al. 2006, Nguyen and Ollinger 2009]. Such structural change has been heavily studied for implications on pricing behavior by processors [Perloff and Rauser 1983, Njoroge 2003, Azzam and Salvador 2004,

Lawrence et al. 2007)³. The use of alternative marketing arrangements to negotiated trade in the food industry was first noted by Hayenga et al. [1979]. Structural change has brought about differences in how the industry conducts commerce.

Immense structural change has occurred in the hog processing sector since 2000. To highlight this change, a timeline was created to show mergers and acquisitions in the hog packing and meat processing industry.

Structural change and changes in commerce within the pork industry are summarized by these nine points: 1 – entities closer to the consumer are more dependent on fewer processors; 2 – publically traded versus privately owned allows different access to capital; 3 – constant expectation for growth; 4 – sustained growth requires either new markets or the acquisition of competitors; 5 – maintaining demand growth requires dedicated supply; 6 – increased need to manage the “profit margin” and “revenue risk” through contracting inputs and outputs; 7 – need for product innovation to sustain, or gain, market share; 8 – increased dependence on other partners in the supply chain increases information sharing; 9 – fewer individuals needed to conduct purchases and sales between entities.

Total hog production increased by 20% from the late-1990s to 2015 (Fig. 1). In 2015, federally inspected industry hog slaughter was 111 million heads, of which

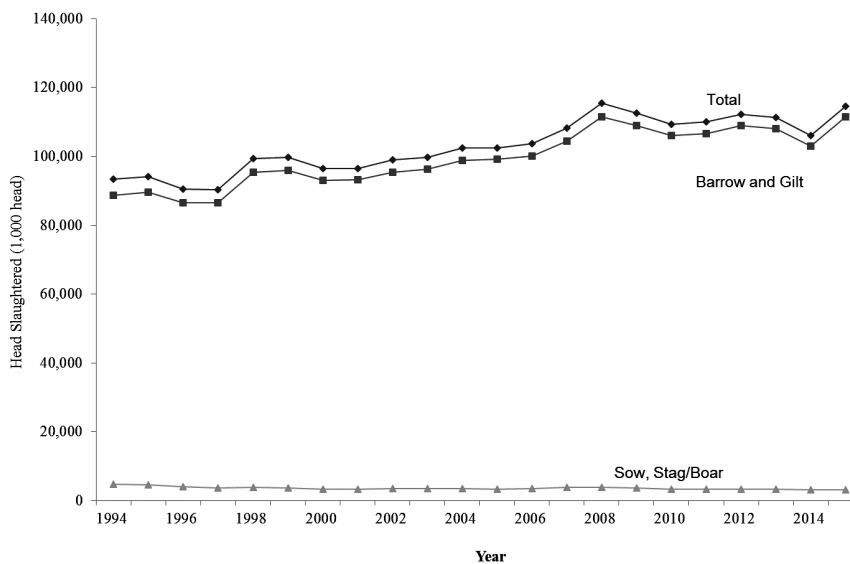


Figure 1. Barrow and gilt, sow, and stag/board annual slaughter from, 1994 to 2015
Source: USDA, ERS, Red Meat Yearbook [various years].

³ Research by Albaek, Mollgaard and Overgaard [1997] and then Stuhmeier [2015] offer empirical evidence and theoretical motivation for how collusive behavior can develop and for why mandatory price reporting can lead to higher expected market prices.

97% was barrows and gilts and the rest were cull sows, stags, and boars. While the number of federally inspected hogs slaughtered has been flat in recent years, federally inspected pounds of pork production continues to increase. The increase in pounds of pork produced has been influenced by an increase in carcass weight over time (Fig. 2). During the past 20 years, the yield of carcass weight to live weight has increased from 72 to 75% of the live hog.

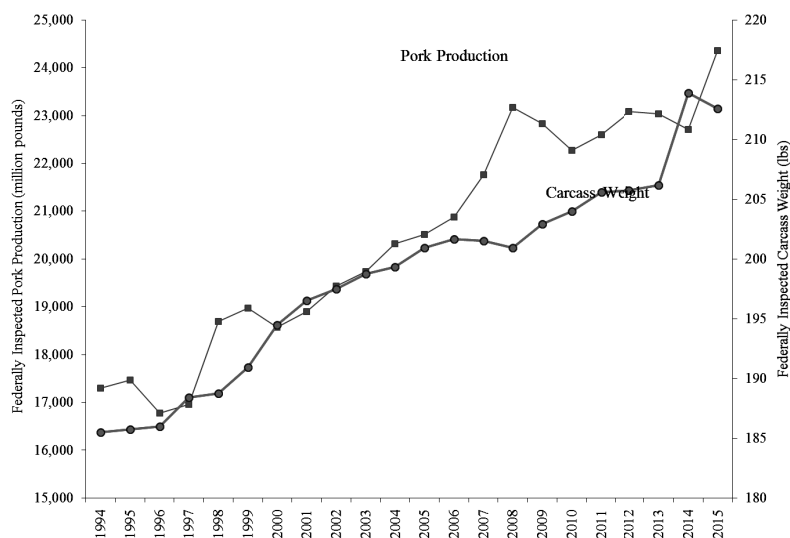


Figure 2. Federally inspected pork production and carcass weights, from 1994 to 2015
Source: USDA, ERS, Red Meat Yearbook [various years].

Slaughter capacity has expanded along with hog production. Firm plant capacity information is confidential, which makes reporting an actual historical account difficult. The trend in annual domestic slaughter capacity is approximated here as the annual maximum daily observed pork production between 1990 and 2013 (Fig. 3). Approximated domestic daily U.S. pork production increased by more than 40% from the mid-1990s to 2015. This trend mirrors the increase in hog and pork production (Figs. 1 and 2).

Pork processing plant managers maximize plant utilization to reduce processing fixed costs per animal [Parcell et al. 2004]. Thus, firms have an incentive to schedule slaughter to minimize excess plant capacity. One advantage of firms entering into forward pricing agreements is that firms can better schedule slaughter.

The daily slaughter capacity of the largest barrow and gilt processors in 2013 is presented in Table 3. Note, JBS purchased Cargill Pork in early 2016. The large plants are located in the southeastern (e.g. NC, VA, and SC) and midwestern (e.g. IA, IL, NE, MN, MO) regions of the United States. A few are also located in the West (e.g. CA). Geographic plant dispersion is important within hog price reporting.

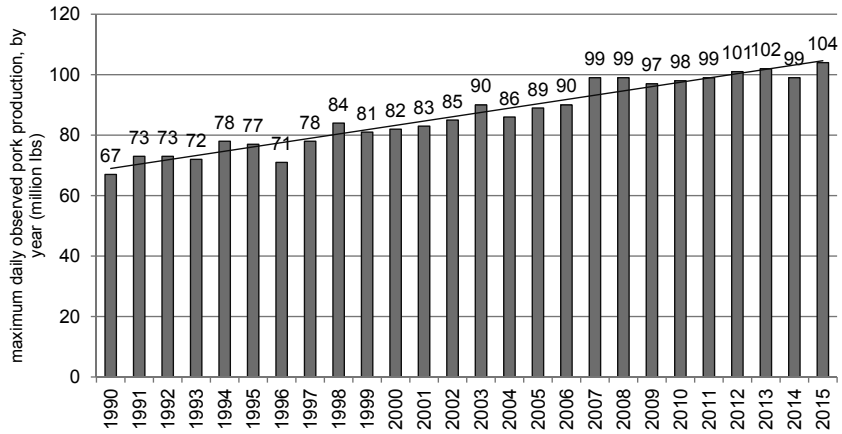


Figure 3. Approximated daily U.S. pork production capacity, from 1990 to 2015
 Source: USDA, ERS, Red Meat Yearbook [various years].

Table 3. U.S. barrow and gilt processors and daily plant slaughter capacities in 2016

Company	Plant	Capacity (head)	Company total
1	2	3	4
Smithfield (Smithfield, VA)	Tar Heel , NC	32 500	
	Gwaltney, VA	10 200	
Morrell	Sioux Falls, SD	19 500	
Farmland	Crete, NE	11 000	
	Denison, IA	10 000	
	Monmouth, IL	10 700	
Prem. Std.	Milan, MO	10 500	
	Clinton, NC	10 600	115 000
JBS (Greeley, CO)	Worthington, MN	20 000	
	Marshalltown, IA	20 000	
	Louisville, KY	10 000	
Cargill Pork	Beardstown, IL	19 400	
	Ottumwa, IA	18 400	89 800
Tyson Foods (IBP) (Dakota Dunes, SD)	Waterloo, IA	19 500	
	Logansport, IN	15 300	
	Storm Lake, IA	17 000	
	Col. Junction, IA	10 100	
	Madison, NE	8 000	
	Perry, IA	8 250	

Table 3, cont.

1	2	3	4
Hillshire/Jimmy Dean	Newbern, TN	2 800	80 950
Hormel (Austin, MN)	Austin, MN	19 000	
	Fremont, NE	10 500	
Clougherty	Los Angeles, CA	7 300	36 800
Triumph Foods	St. Joseph, MO	21 500	
Seaboard Farms	Guymon, OK	20 500	
Johnsonville Sausage	Watertown, WI	850	
	Momence, IL	1 650	
	Holton, KS	1 100	3 600
Indiana Packing Co.	Delphi, IN	17 500	
Hatfield Quality Meats	Hatfield, PA	11 700	
J.H. Routh	Sandusky, OH	4 200	
Rantoul Foods	Rantoul, IL	6 700	
Sioux-Preme Packing	Sioux Center, IA	4 500	
Premium Iowa Pork	Hospers, IA	3 150	
Pork King Packing	Marengo, IL	2 200	

Source: Meyer [2016].

Spatial hog pricing differences are common due to regional pork pricing differences. For example, relative to midwestern prices, southeastern plants might pay a premium for hogs because of pork's higher value in the region and the higher opportunity costs incurred when producing hogs in this region.

CHANGES IN HOW HOGS ARE MARKETED

Livestock and meat products have experienced major shifts over time in how commerce occurs. Figure 4 summarizes changes in relative volumes of hog marketing methods over time. These trends are also summarized by the recent work of Adjemian et al. [2016a, b], while Purcell [1992] was the first to point out pricing and coordination issues as livestock market coordinate. Apparent in this chart is that what USDA-AMS categorizes as negotiated trade has declined precipitously during the past 10 years to 15 years. For example, market hogs went from 15% negotiated to less than 5% as packer-owned hogs nearly doubled from about 15 to 30%. These trends are also summarized by the recent work of Adjemian et al. [2016 a, b].

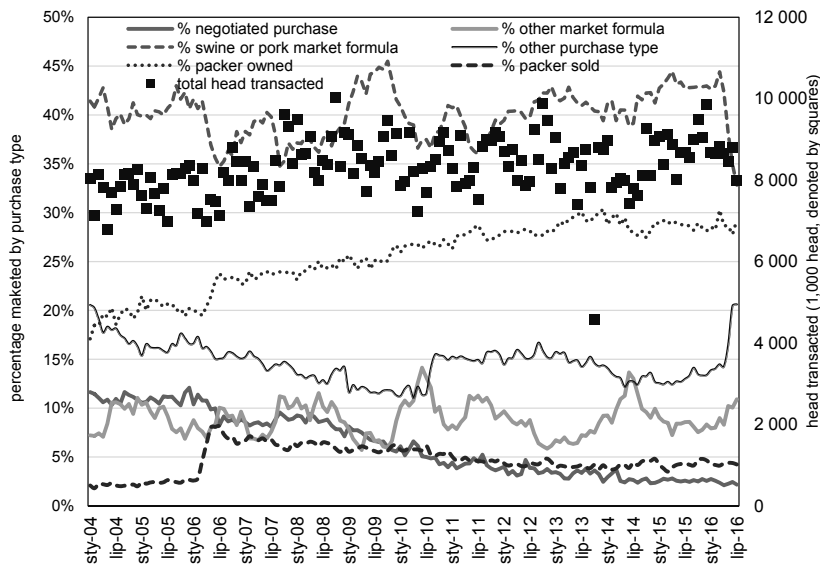


Figure 4. U.S. hogs sold by transaction and total head transacted, monthly 2004 through July 2016 (note: outlier of head transaction for October 2013 is due to a government shutdown and data not collected)

Source: USDA-AMS.

The market price transparency concept has been tied to the quantity of trades used to derive a market price, or price range, for a given market. The term “thin market” describes markets for which reliability of a supply- and demand-determined price is questioned due to an insufficient number of transactions [Hayenga et al. 1979, Tomek 1980, Nelson and Turner 1995]. In 1994, it was estimated that 62% of hogs were sold through negotiated (live or carcass) cash markets. However, by 2013, negotiated (live or carcass) cash sales had declined to less than 4% of trade nationally.

Industry changes have occurred and caused industry to switch away from negotiating prices. For example, packer-owned hogs result from vertical integration in the pork industry and represent a structural change. The pork industry, however, only became extremely concerned about low negotiated trade volume when negotiated transactions fell below 5% of the total.

PRODUCT PROLIFERATION

Barkema, Drabentstott and Welch [1993] were among the first to document the consumer revolution and the food system offering a more discriminating consumer greater choice in food purchases. Since 2000, the U.S. food industry has undergone

significant change to provide consumers with greater choices. The changes in consumer preferences have been well documented [Okrent and Kumcu 2016].

There is considerable product proliferation occurring in meat markets. Increased case-ready product, specialty trimmed cuts, branded products and other forms of differentiation (naturally raised etc.) are adding to a large array of meat products being marketed by reporting packers. For pork meat, packers often add saline solution, flavoring, pre-cook or roast the meat in order to offer the consumer a differentiated product at retail. And, more often, pork processors are adding this value through further processing. Retailers, or butchers, are doing less of this to limit the incidence of food illness associated with handling the meat at multiple points in the value chain. Also, processors are able to capture the economies of size with adding value for multiple customers versus each customer independently carrying out this function. Several researchers have documented the proliferation in U.S. retail-level branding efforts [Parcell and Schroeder 2007, Ward et al. 2007, Schulz et al. 2012]. As more product proliferation occurs, tracking “commodity” prices will be more challenging.

DISCUSSION

Public price reporting provides important information that facilitates trade and enhances market efficiency. Effective price reporting helps individual transaction prices converge more quickly to a market-clearing price. Faster convergence reduces pricing errors, which are costly to market participants and, thus, society as a whole. Publicly reported prices are used as a base in formula-priced trade, which heightens the importance of accurate price reporting. Farmers, processors, LMR data users, importers/exporters, and retailers use historical LMR data to track trends that inform strategic planning efforts. Historical LMR data are used in policy analysis to track and monitor trends in industry practice and structure.

Coase’s [1937] seminal research titled “The Nature of the Firm” and Williamson’s [1985] research on Transaction Cost Economics each won the Noble Prize in Economics. While Coase describes firm existence is due to the cost of using the price mechanism, both Coase and Williamson initiate the idea that firms choose between the “make-or-buy” decisions based on costs of market transactions. Later researchers expanded the “make-or-buy” argument to include concurrent sourcing. The transaction cost research focuses on firm choice to vertically integrate, specialize or vertically coordinate based on the firm’s inherent cost of the transaction, either open market or contract. Depending on the firm’s view of market transaction issues, the firm will choose to organize sourcing, i.e., make, buy or concurrent, to minimize

transaction cost (including uncertainty) associated with the asset specificity issues in the market transaction. Because of uncertainty in hog and pork meat quality and quantity, and more recently price uncertainty, the move by firms in the U.S. hog supply to chase toward vertical coordination and integration is a logical response. Firms are then able to convert the cost of the transaction into firm revenue instead of allowing the value to be leaked to other market participants.

SUMMARY

In summary, the U.S. hog industry continues to evolve toward a more closely coordinated and integrated supply chain for a number of reasons. As long as regulations allow, the U.S. hog industry will continue to grow. U.S. hog industry participants will adapt business plans to adjust to a declining negotiated hog market.

The trends in changing livestock and meat procurement methods have several implications for U.S. hog and pork meat pricing.

1. Negotiated trade is thinning with fewer transactions across every sector being represented in this category [Nelson and Turner 1995]. Formula pricing is becoming more common. Much of formula pricing uses negotiated reported prices as the base in the formula. Thus, negotiated trade is being leveraged more heavily even as it declines in volume.
2. Thin negotiated markets are bringing new forms of pricing into the array of price discovery institutions and platforms. At the same time, traditional derivatives, e.g. CME Group Lean Hog Futures price, are less effective at helping to mitigate price risk today than in the past.
3. Producers are seeking to diversify their price risk, as well as investment portfolio, by owning supply stages closer to the consumer. Producers owning contiguous stages of a supply chain is well studied in the cooperative organization literature, but this organization type seems to relate to a sub-category of vertical integration. Decision making control is one big difference, i.e. collective versus the individual. There is no definitive answer to the question, does collective action or the investor-owned firm vertically integrating lead to a better outcome for the U.S. hog industry.
4. Value-added supply chains are typically shorter supply chains, but producers face more risk because of higher costs. Marketing agreements will dominate this type of supply chain. Retailers will set the price and negotiate margin with processors and producers.

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RECENT ECONOMIC CHALLENGES IN THE HUNGARIAN PIG SECTOR

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Abstract. The aim of the paper is to characterize recent changes in Hungarian pig sector and to find the reasons of this state of art. This study has been prepared by summarizing the experience and results of the empirical researches and literature review carried out by the colleagues of the Institute of Regional Economics and Rural Development on the basis of sector-analyzing method by Szénay. Research showed that biggest challenge ahead of the Hungarian meat sector is to become more competitive at international level. This is impossible without major technological development and the same is true for meeting the requirements of multinational retail chains. An integration process is also inevitable if the sector wants to be more competitive. It is important to mention, however, that certain positive processes and programs have started whose impacts are expected to be experienced in the future.

Key words: competitiveness, Pork Sector Development Strategy, slow withdrawing, investment, small enterprises

INTRODUCTION

The Hungarian pork sector got in a serious crisis in the past few years, however, the problems in the sector stem from the past and they root in deep. The integrations of the producers split up, and as a further negative effect it can be mentioned that the ad hoc interventions in the sector had been frequent before the EU accession providing false incentives for the farmers. The improper preparedness of the country to the EU accession and the difficult adaptation to the requirements in field of environmental protection and animal welfare are all related to the abovementioned. The changes of the subsidizing scheme – due to the EU accession – also have negative impact on the sector. An important characteristic of the sector is that many of the farmers had no crop land for growing feed, so the food price boom in 2008 caused serious feed price increases for these farmers and brought them in an unbearable situation. At the same time those, who had enough arable land, could reach adequate and stable

income stemming from crop production sector due to the subsidizing scheme and the common market regulations. In the meantime animal husbandry, mainly the pig sector got in an uncertain market situation. Therefore, many have given up the risky pig production or the feed production.

The competitiveness of the domestic meat processors is crucial for the future development of the whole sector because they transmit the needs and demand of the retail chains and the consumers to the farmers. The main competitive disadvantage of the meat industry is the high number of the plants, the high proportion of the small slaughterhouses and processing plants and the related unexploited capacity, outmoded technology and the lack of development. However, competitive processing industry can be based only on domestic raw material production in adequate quality and quantity, so it cannot be built on import products. It should be mentioned that there are some companies in the Hungarian meat industry which meet the strict competitive requirements of the unified market (Spar processing and cutting plant, Pick Szeged, Délhús and their integration etc.). The program declared by government in 2012 and the established strategy for the development of the sector increased mainly the number of the small pig keeping farms which causes further competitive problems.

AIM AND RESEARCH METHODOLOGY

The aim of our article is to characterize recent changes in Hungarian pig sector and to find the reasons of this state of art. This study has been prepared by summarizing the experience and results of the empirical researches and literature review carried out by the colleagues of the Institute of Regional Economics and Rural Development on the basis of sector-analyzing method by Szénay [Szénay 2000]. The structure of our paper follows the above-mentioned method by analyzing the supply and demand market conditions and the actors of the sector. However, we did not investigate the type of the competition on the market, the factors influencing the income of production as well as the regulatory measures from the elements of the sector-analyzing method. Though the last overall questionnaire survey for the slaughter houses and meat processing companies was carried out in 2009, we have had regular contact with the market players since then, therefore there has been enough experience and information collected about the development potentials of the sector.

DISCUSSION

Factors influencing the market of the verticum

Meat consumption tendencies in Hungary

Due to the changed economic circumstances and income conditions after the change of regime, meat consumption has decreased in Hungary (Fig. 1). In the late 1980s and early 1990s, meat consumption per capita was 72–75 kg, with pork having 50%. On the contrary, it was only 54.9 kg in 2012, out of which 24.5 kg of pork. Poultry consumption is higher than pork because healthy diet requires white meat, mainly the consumption of chicken. However, human body needs red meat too because it contains important minerals, iron, zinc and vitamin B.

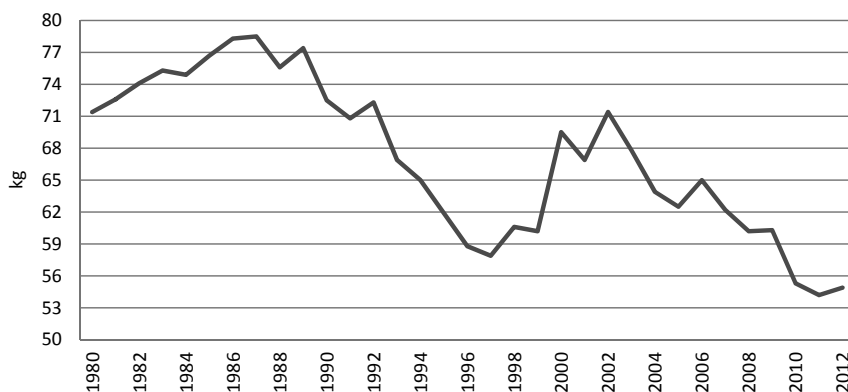


Figure 1. Annual meat consumption per capita in Hungary in years 1980–2012
Source: CSO [2016].

Figure 2 shows that poultry consumption represents a great share in consumption. The difference between pork and poultry was not significant in 2012 but it is important to mention that poultry consumption was almost half of that of pork at the change of regime (Fig. 3). Since 1980s, nearly all the meat consumption has decreased, except for poultry. In addition, beef consumption has reduced from 9 to 2.4 kg in 2012. Regarding sheep, its consumption has never been high – it was only 0.5 kg in the 1980s which decreased further to 0.2 kg by 2012. On the contrary, poultry consumption increased to 24.4 from 18 kg, however it also saw decrease after 2002 (35.1 kg). Ten years later, it was only 25.4 kg.

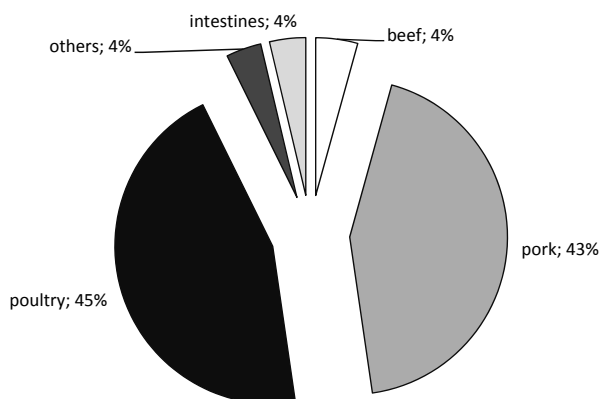


Figure 2. Distribution of meat consumption in Hungary in 2012
Source: CSO [2016].

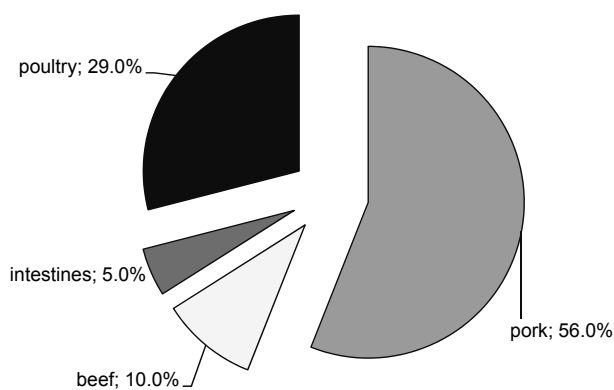


Figure 3. Distribution of meat consumption in Hungary in 1987
Source: CSO [2016].

The pork consumption was the highest in 1987 and the total meat consumption per capita was also at the highest level in that year. There were two special influencing factors that should be emphasized in the case of meat consumption. The beef consumption decreased continuously, because of the changing traditions and habits, and on the contrary, the poultry consumption started to grow at the expense of pork due to economic reason and the spread of a healthy lifestyle.

Regarding pork sales, the share of pre-packaged meat is growing in Hungary, following the Western European trends; the same is true for poultry products. Small-size products are more and more popular and there is also growing demand for special products (gluten-free, soy-free, organic etc.).

Pork production in the world

According to the forecasts of FAO, pork production is expected to reach 127 million tons in 5 years (Fig. 4). The production in developing countries has been continuously growing, while in Europe, the number of pigs is decreasing due to the increasing prices of feed.

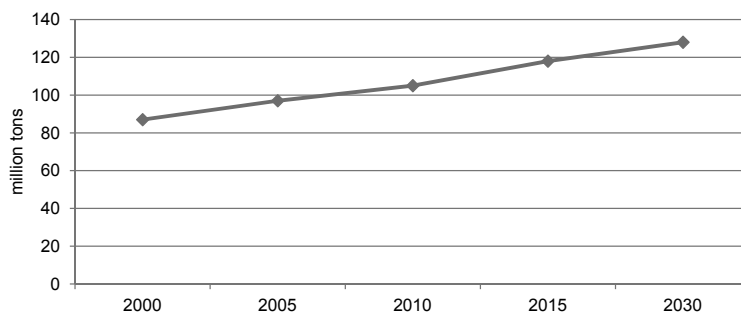


Figure 4. Global pork output in years 2000–2020
Source: Versenyképes sertéshizlálás [2013].

At the same time, FAO says that the modern technologies for keeping pigs are expected to be applied by only the developed countries. Nearly 50% of the world's pork production is produced in China. The EU represents another 21%. The USA, Brazil, Canada and Russia play also important role [Popp et al. 2013].

The pig population in the EU-28. Considering the global tendencies, the pig population of the EU shrank by 10 million over 10 years, however half of the total meat production is represented by pork (Fig. 5). Europe's biggest pig keeping nations are Germany, Spain, France, Poland, Italy, Belgium and the Netherlands. In the case of the two latter countries, the number of pigs per capita is extremely high. Because of the 2008 global crisis, the demand for meat in the old member states stagnated, while it decreased in the recently joined member states. Between 2006 and 2011, the number of sows also decreased by 16%. Since 2013, there has been an animal welfare regulation (2008/120/EC) in effect which says that sows have to be kept in groups. The reconstruction of stalls increase the costs further. Consequently, the population of pigs may decrease by 5% by 2020. "Feed costs of keeping pigs used to be 50% of the total costs, while they reach 65–70% nowadays. Moreover, it is also a difficulty that because of the prohibited protein of animal origin, the pig keepers in the EU have to buy protein feed from abroad as import" [Popp et al. 2013].

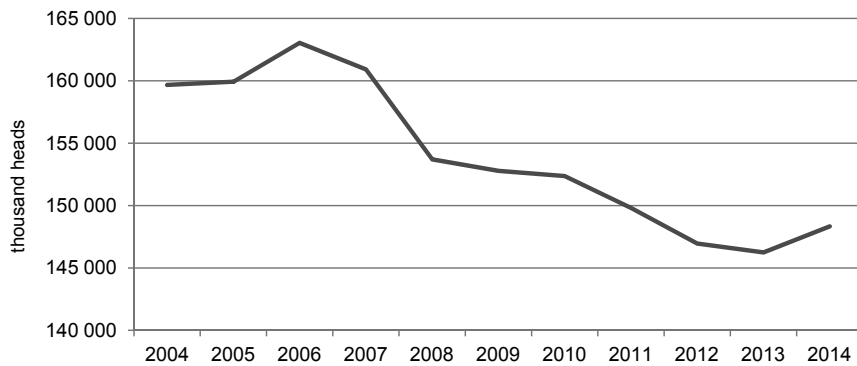


Figure 5. The changes in the pig population of the EU-28 in years 2004–2014
Source: CSO, Eurostat [2016].

The changes in the Hungarian pig population follows the above-mentioned processes (Fig. 6) but with some differences – mainly in the consumption patterns and data.

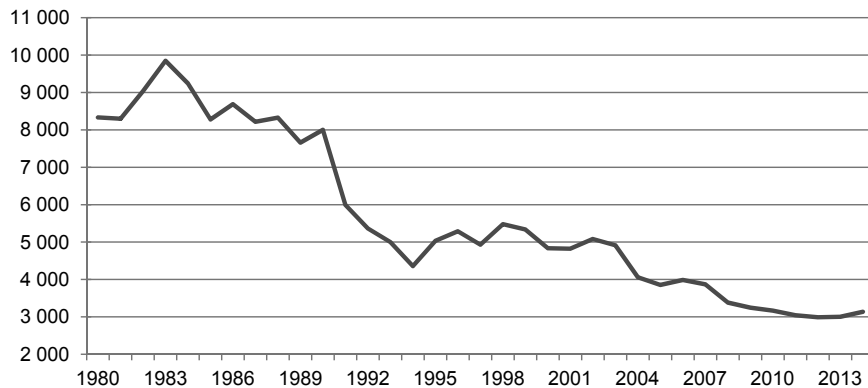


Figure 6. Pig stock in Hungary in years 1980–2013
Source: CSO [2016].

The pig stock decreased dramatically to one third in the last 30 years in Hungary but the situation was the same in the EU. Such a dramatic decrease in the Hungarian pork production is the result of many parallel existing problems. Authors can find the main reason for this problem in various factors. Bartha [2011] finds in her research that the main reason for the extraordinary hard situation and the stock decrease in the sector was the privatization. Due to the privatization of the state property, the animal keeping and crop production separated from each other. The recently

established enterprises oriented toward plant production and they ceased their animal keeping capacities. This tendency was encouraged by the CAP after the EU accession, because its regulation and direct subsidy scheme provided certain income and profitable operation for them. The CAP created more difficult circumstances for the sector because of the regulations the sector specific subsidies ceased and left narrow margins for the national policy [Baksa 2013]. Csonka [2011] states that the biggest problem of the Hungarian pig sector is the poor natural efficiency indices (i.e. feed realization index) “the producers used 1 kg more feed for 1 kg weight gaining in 2005 like the Danish, Dutch and Spanish farmers” [Nyárs 2008]. This difference in the feed utilization increases purely the costs of pig fattening by 40–50 Ft/kg compared to the above-mentioned countries on the basis of the prices in 2009 [Agrárgazdasági Kutat Intézet 2010 [Csonka 2011].

The structure of raw material production in the European Union

The distribution of the pig population by size of the pig herds (in numbers of other pigs) shows that 1.7% of pig farms have at least 400 other pigs and rear 77.9% of these and 48.6% of the sows. In twelve Member States (Belgium, the Czech Republic, Denmark, Estonia, Ireland, Spain, France, Italy, Cyprus, the Netherlands, Sweden and the United Kingdom) the herd size of 400 other pigs is more than 90%, while in Poland and Romania this category is approximately 33%. Animals kept in small units of less than 10 other pigs are important in Romania (62.8%), Croatia (45.3%), Slovenia (31.4%), Lithuania (28.8%) and Bulgaria (25.8%). At the EU level, although these small units rear 3.8% of other pigs, they account for 73.3% of the pig farms.

The breakdown of other pigs among the four types of pig farm is shown by country in Figure 7.

- The small fatteners (no sows and fewer than 10 other pigs) represent a significant share of pig production and at least 10% of other pigs in seven of the newest Member States (Bulgaria, Croatia, Latvia, Lithuania, Hungary, Romania and Slovenia). The importance of own consumption in pig production limits the sensitivity of this type of production to market conditions.
- The large fatteners (no sows and at least 400 other pigs) account for more than one third of other pigs in 10 countries (Belgium, Denmark, Germany, Spain, Italy, Luxembourg, the Netherlands, Finland, Sweden and the United Kingdom). They reflect a production organized between specialized breeders (which nevertheless have other pigs) and fatteners. These 10 countries represent two thirds of the other pigs and three quarters of the EU pork production. In France, the distribution is intermediate between typical fatteners or large breeders.

- The large breeders (at least 400 pigs and 100 sows) manage more than two thirds of the other pigs in six countries (the Czech Republic, Estonia, Ireland, Greece, Cyprus and Portugal), where production is concentrated in a less-organized production sector. This class feeds also half of EU-28 sow herd.
- The other pig farms manage more than two thirds of other pigs in Greece, Malta, Austria and Poland, which reflects a certain level of concentration, but one which is limited by the farm size. Latvia, Hungary, Slovenia and Slovakia, with almost two third of the other pigs in such farms, can also be included in this group.

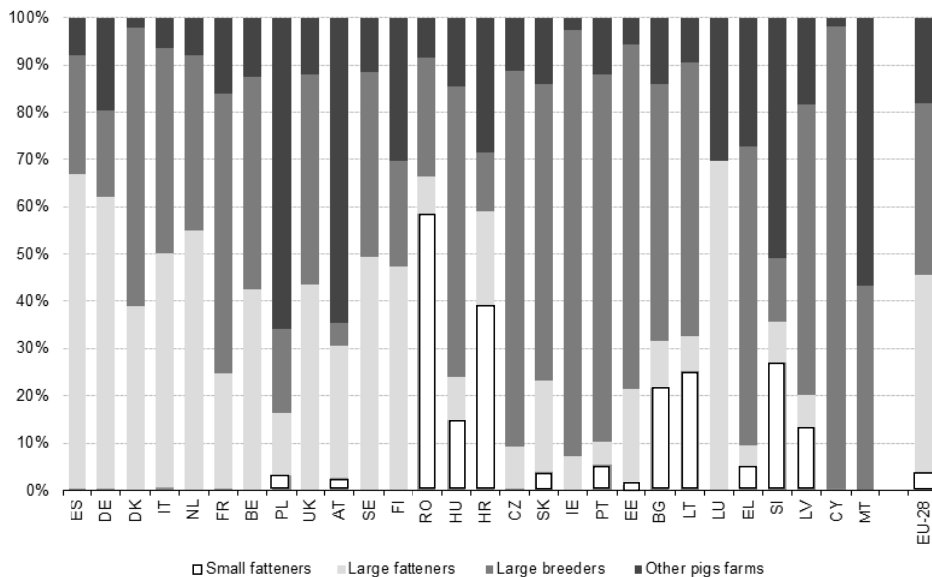


Figure 7. Distribution of other pigs by type of pig farm

Source: [http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Distribution_of_other_pigs_by_type_of_pig_farm_\[FSS_2010\].png](http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Distribution_of_other_pigs_by_type_of_pig_farm_[FSS_2010].png).

The structural data on the changes in the number of sows from large farms with at least 200 sows and those from small farms with fewer than 10 sows enables us to classify Member States' pig sectors into three types:

- **Concentration.** In 11 Member States, large farms account for more and more sows to the detriment of the smallest farms. These Member States account for less than half (42.8%) of the EU sow herd according to the December 2013 livestock survey. Generally speaking, in these countries the surviving farmers are only those that have understood the need of having sustainable production based on investments in technology, genetics, nutrition and integration.
- **Abandonment.** The decrease affects pig farms of all sizes, including large farms in 15 Member States. These account for 48.6% surveyed in December 2013.

- Restructuring. In two Member States, namely in Croatia and Poland, the number of sows from small herds fell sharply and the number in the medium and large herds rose correspondingly. This can be interpreted as a re-organization of production. These herds accounted for 8.6% EU sows, according to the livestock survey in December 2013 [http://ec.europa.eu/eurostat/statistics-explained/index.php/Pig_farming_sector_-_statistical_portrait_2014].

The background reasons for the Hungarian pork production structures. As we mentioned before, the Hungarian pork production is featured by small farms and abandonment. According to the farm-structure survey of the Central Statistical Office (CSO) in 2013, 5% of the companies (474) and 28% of the individual farmers (133 thousand) kept pigs. In 2013, the size of the herd did not reach 2.9 million, while the sow population was 192 thousand. The number of the pig keeping companies decreased by 9%. The same tendency could be seen in the case of the individual farms, their number also decreased but by a higher rate, namely by 27%, compared to the data from 2010. The pig population decreased by 5% in the case of the companies and 23% in the case of the individual farmers since 2010.

A kind of concentration process started in the distribution of the pig production between the types of farms. This statement can be underpinned by the fact that 58% of the 4 million pieces was found at companies and the remaining part was kept by individual farmers at the time of the EU accession and this ratio dramatically changed for the year 2014. 74% of the 3.1 million pieces was kept by companies (Fig. 8). 85% of the pig population kept by the companies could be found at farms

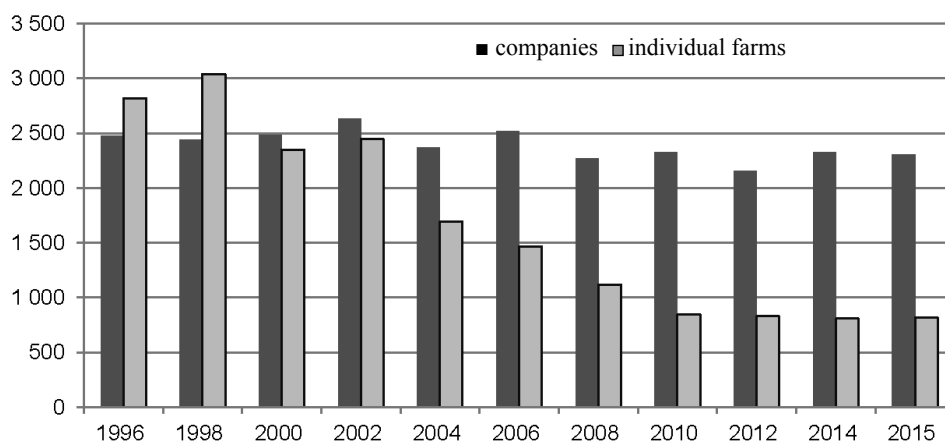


Figure 8. The distribution of the pig stock between the types of farming organizations in years 1996–2015

Source: CSO [2016].

which have more than 5 000 animals. However, 54% of the pig keeping farms have only 1–2 pieces, 36% of them kept 3–9 pieces, according to the farm survey of the CSO in 2013. So the situation is complex and contradicted.

The sector suffered the most serious decrease at the change of regime, when many of the producing co-operatives ceased their activity. There was also a massive decrease in 2004 which was due to the EU accession. Because of the single market, the ratio of the cheap import pigs increased, which depressed the domestic prices and in parallel increased the loss in the production. The strict environmental and animal welfare requirements also meant a big burden on the farmers in the cost structure. Due to such reasons, the pig keeping farms ceased their activity constantly from year to year. Further reason for the decrease could be the unprofitable production, since only a few plants had high technical level. Most of them need modernization because of their poor technical level. All of this require so much investment which farmers cannot afford.

Since 2009, the individual farmers have kept less than 1 million pieces of pig. The sector reached the lowest value in 2013, when the pig stock was only 803 thousand on these farms, 27% of the total pig population. From this date, the pig stock kept by the individual farmers had increasing trajectory, it reached 820 thousand pieces in 2015. The trigger effect of this increase was the National Pig Strategy accepted in 2012.

The Hungarian government accepted a program aiming at the development of the Hungarian pig sector. They want to improve the domestic consumption, gain new international market for the pork products, strengthen the market position of the Hungarian processors, increase the pig stock and reach 6 million pieces. Further aims are the helping of the co-operation among the raw material producers, meat industry, retailers and the public sector, the trust increasing and the decreasing of the administration, legal and tax burden on the sector [Wagenhoffer 2013, Horváth 2015].

The main reason for the establishment of the program was the drastic decrease in the pig population and in the domestic pork consumption as compared to the previous years [Nemzeti Agrárgazdasági Kamara 2016].

The aim of the program is the increase of pig population with the depression of the illegal economy which has a big ratio and exceeds 40% according to some experts. The government tries to reach this aim with the reduction of the VAT on pork from 27 to 5%. According to the first results, the population grows, the VAT swindle decreases and the economy becomes whiter [Magyar Távirati Iroda 2015, Horváth 2015].

There are other disadvantageous factors relating to the profitability of the Hungarian pig sector. Because of our climate we have high heating costs in winter to

keep the newborn piglets warm and high cooling costs in summer. In addition, the costly road transport dominates in Hungary in the sector. Moreover, since there is a prohibition of the use of animal protein in feed, the purchase of import protein, mainly GMO free soybean, is expensive. The domestic prices depend mainly on the German prices which diverge from the Hungarian production costs [Popp et al. 2013].

Békés County is a traditional pig breeding area, it is one of the most important pig producing county in Hungary. The famous Gyulai Húskombinát can be found in this county so the Pig Strategy of Békés County is built on this processor to a great extent. If we use the Bartha sort [Bartha 2011] strategy analyzing method to analyze the Strategy, it turns out that the “slow withdraw” from the sector would be the best alternative for the County instead of the development. The appearance and increasing number of the pigs leased out for fattening and the related integration forms are again important phenomena among the farmers.

The situation of the Hungarian pork industry

The recent structure of the meat industry was influenced mainly by the historical determination dating back to the time before the system change and the events from this date. Many enterprises started at the beginning of the nineties. The bigger enterprises operated in the form of corporation or limited company and the privatization of the bigger firms also dated back to this time. Because of the unsuccessful corporation management of the financial investors, the period after the privatization was the time of the fusions, acquisitions and through these processes the time of the empire building [Bojtárn et al. 2009].

The opportunities, competitiveness and the applied strategies of the sector determine basically the situation and operating circumstances of the lower stages of the product chain. The whole food producing process was coordinated by the processing industry in the countries with well-developed and competitive food industry. The food industry is adapted to the needs of the retail chains and the consumers and it cannot be neglected that the competitiveness of the processing companies depend on the agricultural production to a great extent [Nyárs and Papp 2002, Potori and Udovecz 2004].

According to Nábrádi [2007], the processors have all the development tools of quality production influencing competitiveness. The technological and product development which are applicable to improve quality are concentrated in the processing sector. Juhász [2006] emphasizes, that the reason for the low proportion of the foreign capital in the industry is the inefficient structure of the industry, the high proportion of small companies, the capacity excess, the depressed domestic market and the lack of strong brands.

Bartha [2011] stated in her primary research that the meat processors were in the hardest situation among the interested parties in the supply chain. This stage lies under the pressure of the retail chains and the will of the producers. However, she thinks that this disadvantage can be avoided by well-organized integrations. She emphasizes that not only these problems influence the situation of meat industry [Bartha 2011]. In our Institute the latest overall survey was carried out among the Hungarian slaughterhouses and processing plants in 2009, though we have kept regular contact with the different interested parties in the supply chain since this date.

The plants can be characterized by diversified range of activity. Overall, it can be stated that investments carried out at the companies primarily aimed at the catching up in technological development, moderating the lagging behind positions. In relation to this, keeping the market positions against the cheaper imported processed products is a really important factor. There is no strong cooperation between the producers and the processing companies. The mainly short-term, ad-hoc contracts are not able to provide continuous raw material and to create stable production base. A few companies try to maintain their competitiveness by producing special, unique products, though the latter one is expected in the case of small-scale meat processing companies. All in all, we should state that concentration, specialization processes have not started yet, most of the foreign investments aimed at only gaining market, increasing market share. The real integrations of producers, processors and traders are totally missing from the domestic pig sector.

To sum up, the main tendencies and factors, we can state the followings. There are approximately 400 actors in the Hungarian pig and pork production sector. It is one of the reasons why there is no Hungarian meat company that can be competitive on international level. With the exception of a few businesses, capacity utilization is at a low level in the sector. The Hungarian meat companies are very much lagging behind from a technological perspective. It is a big problem that SMEs do not even have a chance to get any funding for development purposes in the near future.

CONCLUSIONS

To sum up, the main conclusions we collected the most important factors affecting the pig sector in the recent past:

- the decreasing tendency of the pig population started after the system change with the privatization;
- the unpreparedness for the EU accession froze the confused situation following the system change for a long time;

- the price boom of 2008 affect the domestic pig sector negatively, because most of the farmers had no crop land for growing feed;
- those farms which had arable land for feed growing could count on secure income from the crop growing due to the Single Area Payment Scheme and the secure cereal market, that is and the risky pig market situation why many ceased their production;
- there is no unified interest protecting organization because of the unorganized sector;
- there is no tradition of the integrating organizations, the attitude formed in the processing and pig keeping sectors do not help the development in this field.

The biggest challenge ahead of the Hungarian meat sector is to become more competitive at international level. This is impossible without major technological development and the same is true for meeting the requirements of multinational retail chains. An integration process is also inevitable if the sector wants to be more competitive. It is important to mention, however, that certain positive processes and programs have started whose impacts are expected to be experienced in the future.

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SPACIAL DIFFERENTIATION OF LIVE PIG PRODUCTION IN THE EUROPEAN UNION

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Abstract. The aim of the paper is to characterise the special differentiation of live pig production in the European Union. For this purposes secondary data sources from public statistics were used. Research showed that the world market and the EU market of pig production keep differentiating. Next to the countries with the downward trends in the live pig inventory and production there are countries that increase their production volumes. Different levels of production costs in individual countries will lead to further movement of the pig population from the countries with higher production costs to those that are able to produce pig livestock at a lower cost. Livestock prices vary between countries both globally and in the European Union. The liberalization of trade with the USA and Canada may slightly weaken the competitive advantages of EU producers but it is not necessarily inescapable. The development of pig farming and production of live pigs in Poland faces a number of barriers.

Key words: pig production, differentiation, costs, barriers

INTRODUCTION

Over recent decades the demand for pork has been increasing both as a result of population growth and due to changes in the consumption patterns. For this reason, pig farming is next to poultry the fastest growing sector of meat production.

Pig production is global, excluding those regions of the world in which for cultural and religious reasons pork is not eaten. A characteristic feature of the world's pig production is a dual development of production systems [Farmer's...]. On the one hand there is traditional production, carried on a small scale, on the other pig farming is developed within the technology of industrial character.

Changes in the technology of pig farming and a biological and organizational progress in recent decades have contributed to the increase in the production capacity of this species. To take full advantage of the increasing genetic potential of pigs it is necessary to ensure proper environmental conditions and nutrition [Kulisiewicz

and Blicharski 2005]. Small producers find it is difficult to meet these requirements. It does not prevent them, however, from producing live pigs on a small scale, using local hybrids adapted to local conditions. However, in the so-maintained pig farming it is not possible to ensure competitiveness in the global market. For these purposes it is necessary to develop large-scale production while ensuring high production quality and efficiency. The essentials of competitive strength in the export markets include:

- low production costs (this is not a guarantee of persistence though);
- standardized production with high productivity;
- high quality and safety of products;
- reliability of supply;
- animals well-being;
- reduction of negative effects on the environment.

The aim of the paper is to characterise the special differentiation of live pig production in the European Union. There were applied general methods of economic analysis including dynamics of production, export and import, price fluctuations and their periodicity, etc. There was cause-effect analysis applied in order to find the reasons for the observed occurrences. For this purposes secondary data sources from public statistics were used.

GLOBAL PERSPECTIVE OF PRODUCTION OF PORK AND OTHER TYPES OF MEAT

Pork meat represents a very high percentage of the total meat production both globally and in the European Union (Table 1).

Table 1. Meat production in the world and in the EU-28 (thousand tons) in 2013

Specification	Meat production				
	all	beef	pork	poultry	sheep and goat
EU-28 (thousand tons)	43 124	7 373	22 359	12 510	882
EU-28 share in world production (%)	100	17.0	52.0	29.0	2.0
World (thousand tons)	303 372	67 706	113 035	108 669	13 962
EU-28 share in world production (%)	100	22.3	37.3	35.8	4.6
EU-28 share in world production (%)	14.2	10.9	19.8	11.5	6.3

Source: Eurostat.

The pork meat accounts for about 38% of the total meat production in the world. In the European Union this share is even higher because pork represents more than half of the total meat production. As the data in Table 1 show nearly 1/5 of the world's pork is produced in the European Union. Despite a marked increase in the production of poultry meat, pork maintains its leading position in the world's and EU meat production, although due to the large increase in poultry production differences between the world production of poultry and pork meat are recently rather small.

PRODUCTION OF LIVE PIGS

Production of live pigs is spatially differentiated. The world's largest producers of live pigs include China, the European Union, the United States and Brazil (Fig. 1).

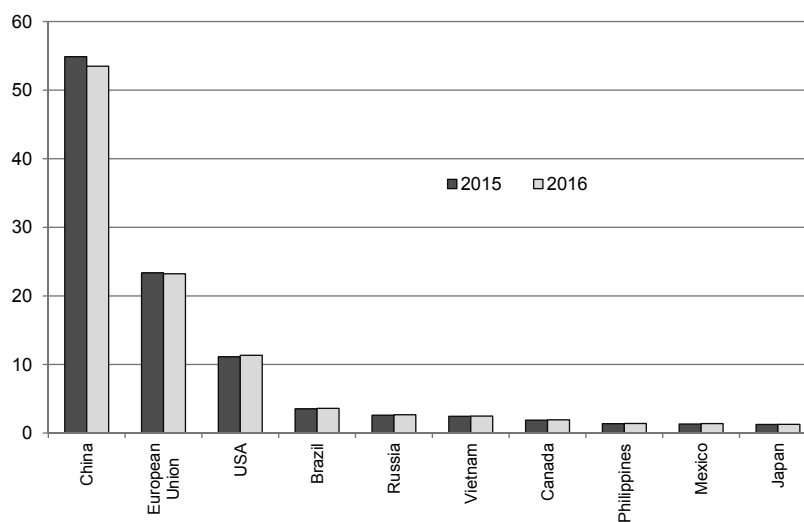


Figure 1. The world's largest producers of live pigs in 2015 and 2016
Source: USDA Foreign Agricultural Service (Access: 7.11.2016).

Other major producers represent such countries as Russia, Vietnam, Canada, the Philippines, Mexico and Japan. In 2016, an estimated production of live pigs in China will decrease, similarly to the EU countries which are expected to record a modest fall in production. In the same period the rest of the above-enumerated countries, including the United States and Brazil, are expected to increase the production (Table 2).

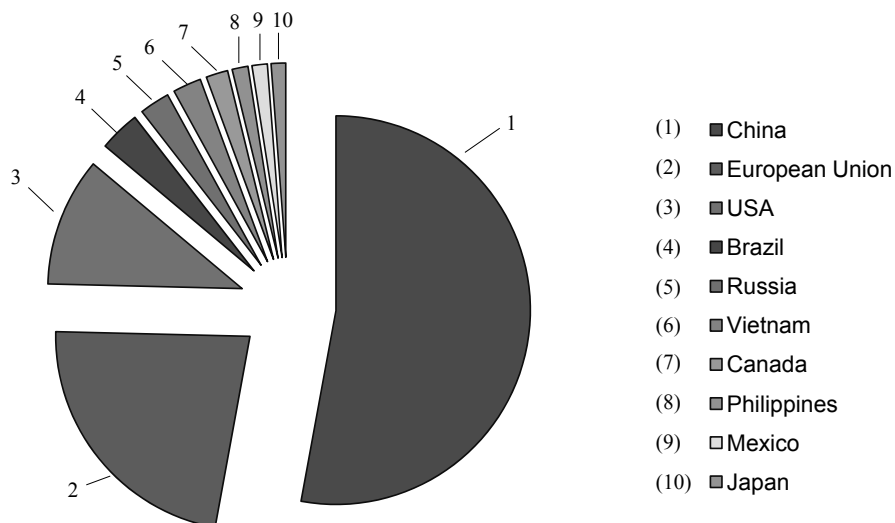
Table 2. Countries with the largest live pig production in the world in 2015 and 2016

Country	2015	2016 ^a	2015 = 100%
China	54 870	53 500	97.50
European Union	23 350	23 230	99.49
USA	11 121	11 334	101.92
Brazil	3 519	3 609	102.56
Russia	2 615	2 675	102.29
Vietnam	2 450	2 475	101.02
Canada	1 890	1 925	101.85
Philippines	1 370	1 400	102.19
Mexico	1 323	1 385	104.69
Japan	1 254	1 280	102.07

^aprognosis

Source: USDA, Foreign Agricultural Service (Update: 07.11.2016).

The analysis of the structure of live pigs production by 10 largest world producers of live pigs in 2015, as illustrated in Figure 2 shows that China and the European Union as the world's largest producers of live pigs provided in total for approx. 3/4 of production, of which more than half came from China, and around 1/4 from the European Union. A significant share in this production had also the USA.


Figure 2. The world's largest producers of live pigs in 2015

Source: USDA, Foreign Agricultural Service (Access: 07.11.2016).

EXPORTS OF LIVE PIGS AND PORK

Given the structure of exports of live pigs (Fig. 3), it should be noted that the major exporters of pork in the world are the European Union, the United States, Canada and Brazil. Important positions have also such countries, as: China, Chile, Mexico, Vietnam and Australia.

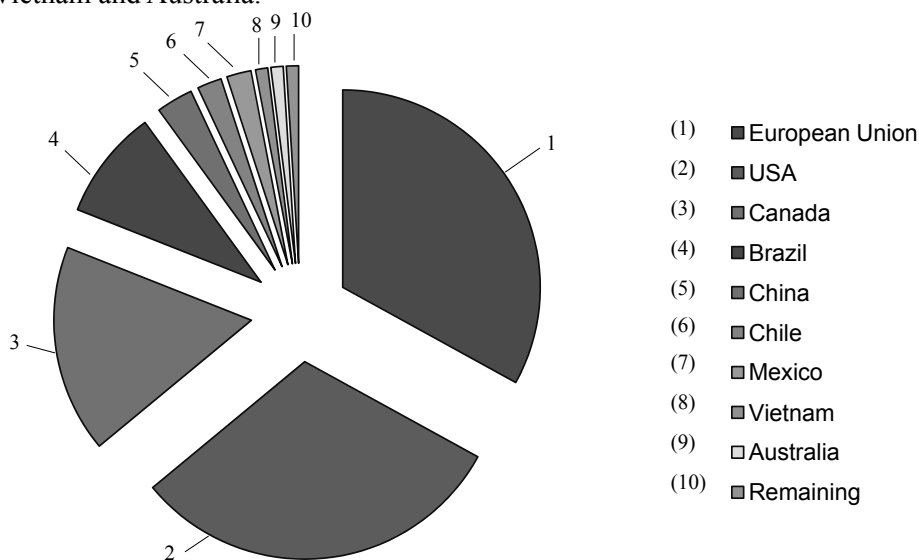


Figure 3. Global structure of pork exports by countries in 2015
Source: USDA, Foreign Agricultural Service (Access: 07.11.2016).

LIVE PIG PRODUCTION IN THE EUROPEAN UNION

In the European Union the leading producers of live pigs are Germany, Spain, France, Poland, Italy and Denmark (Fig. 4).

Slightly smaller numbers of live pigs are also produced by such countries as the Netherlands, Belgium and the United Kingdom. The data presented in Figure 4 show that the differences between EU countries are very large. Next to the countries which are leading producers of live pigs there is quite a long list of countries that have very small live pig production. These include, apart from Malta and Luxembourg, such countries, as: Slovenia, Latvia, Estonia, Cyprus, Slovakia, Bulgaria, Lithuania, Croatia and Greece. This differentiation stems not only from different agricultural areas but is also due to other reasons, including organizational, economic and socio-cultural ones.

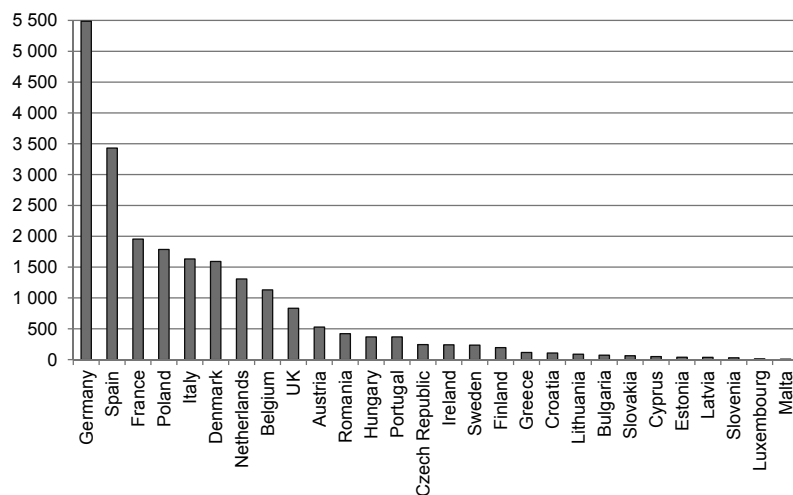


Figure 4. Slaughter of pigs per tons in 2015
Source: Eurostat.

The production of live pigs is related to the level of the pig population and its productivity. The pig inventory in the European Union numbers about 146 million units (Fig. 5).

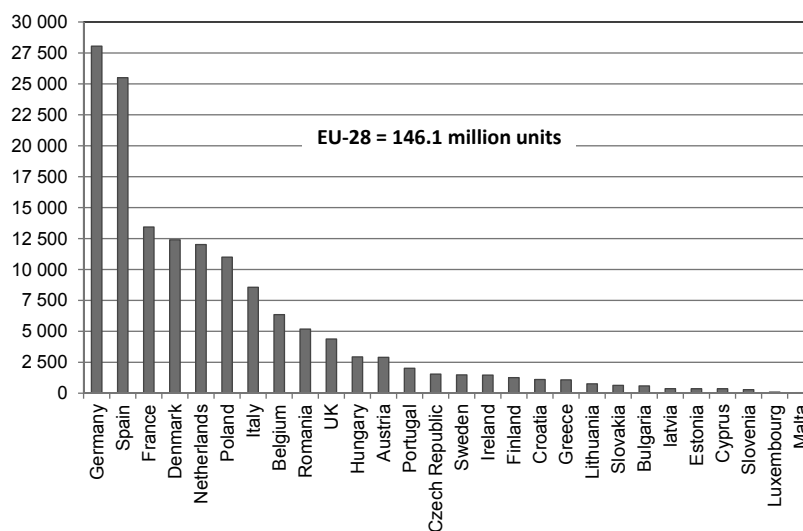


Figure 5. Pig inventory in the EU in 2015 (thousand units)
Source: Eurostat.

Two EU countries, i.e. Germany and Spain, account for over 1/3 of the pig population in the European Union. A significant pig inventory can also be found in France, Denmark, the Netherlands, Poland and Italy. It should be noted that the pig population in Poland has considerably reduced upon the EU accession and is now about 11 million units. The countries with the lowest pig inventory in the EU are Malta, Luxembourg, Slovenia, Cyprus, Estonia, Latvia, Lithuania, Bulgaria, Slovakia and Lithuania. Table 3 presents data on the production of live pigs and pig population in the European Union. The data contained herein show that Germany is the undisputed leader in both pig population and in the production of live pigs.

Table 3. Production of live pigs and pig inventory in the selected EU countries in 2011

Specification	Production (thousands tons)	Population (million heads)
Germany	5 598.0	28.3
Spain	3 479.5	25.3
France	1 998.3	13.8
Poland	1 810.8	11.1
Denmark	1 718.4	8.7
Italy	1 570.2	12.3
Netherlands	1 347.2	12.1
Belgium	1 108.3	6.4
UK	806.0	4.2
Austria	543.8	3.0
Portugal	383.8	2.0
The rest of the EU	2 024.0	19.8
EU-28 all	22 388.0	147.0

Source: Eurostat.

The second position is occupied by Spain and third by France. Denmark holds a special place. Despite the fact that in this country the pig inventory is much lower than in Italy, the Netherlands or Poland, the production volume of live pigs there is higher than in Italy or the Netherlands, and slightly lower than in Poland. This indicates a significant difference in productivity per animal unit.

When observing the changes taking place in the pig production in the European Union it should be noted that small farms withdraw from pig farming while the share of pigs kept in large herds increases. It applies to both production of piglets and the fattening phase. This trend is visible not only in the leading producers of live pigs in Europe, but also in other EU countries. Figure 6 shows the changes in the sows inventory kept in herds of different sizes.

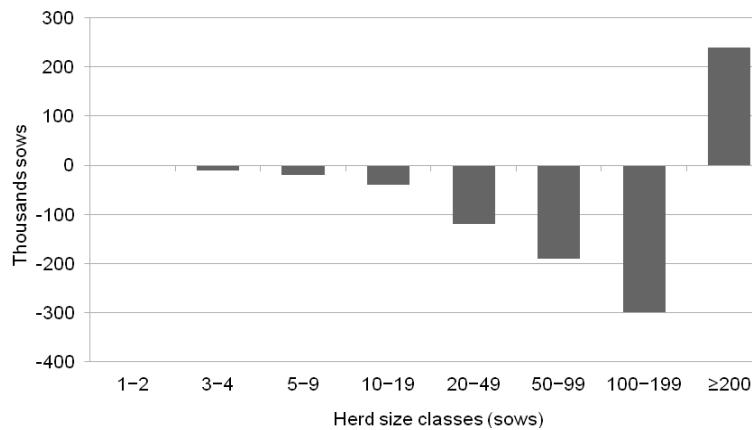


Figure 6. Change in the number of sows in Belgium, Germany, Estonia, France, Latvia, Luxembourg, the Netherlands, Austria, Portugal and Finland in the years 2007–2010

Source: Eurostat.

CHANGES IN THE CONCENTRATION OF PIG FARMING

It appears that in the analysed period the number of sows in herds of up to 200 units significantly reduced whereas it increased in herds of 200 or more. The process of inventory concentration in pig farming is essential for the economies of scale [Runowski 1994]. The advancement of concentration in pig production varies between EU countries. This phenomenon is illustrated in Figure 7 which shows that on average, in the entire group of the EU-28 nearly 80% of sows are concentrated in herds of more than 400 units. The group of countries representing a relatively small advancement in concentration processes includes but is not limited to Slovenia, Croatia, Romania, Poland and Austria.

In turn, the group of countries with the highest level of sow concentration includes Denmark, Cyprus, Ireland, Italy, Estonia, Spain, Belgium, the Netherlands, the United Kingdom, Sweden, the Czech Republic, France, Slovakia, Portugal, Luxembourg and Germany.

These analyses show that larger farms (with more than 400 sows) are more effective than agricultural holdings with medium and low concentration of livestock. The scale of farming is a key element in determining the economic viability of pig farming [Runowski 1994]. Smaller farms are not able to face the competition from large farms which achieve greater productivity and benefit from greater economies of scale.

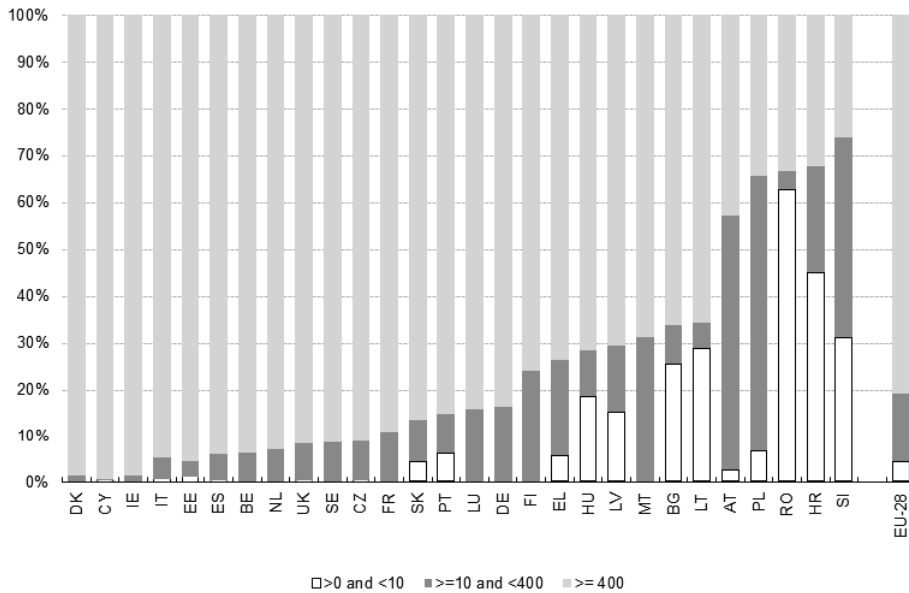


Figure 7. The structure of sows according to the size of the herd in the EU (15 old and 13 new Member States)

Source: Eurostat.

LONG-TERM TRENDS IN PIG FARMING IN THE EUROPEAN UNION

When analysing long-term trends in pork production in the European Union there can be noticed a slight downward trend in production throughout the EU.

However, when taking into account the countries of the “old” European Union (EU-15) a different conclusion can be drawn. In there the production tends to increase. The main reasons for this occurrence are the increasing levels of density of pigs, a higher efficiency of production or better organized relationship between the sphere of production and the sphere of pork processing and trade. The costs of production are also relevant here. These costs vary between countries. For example in 2014 they presented per countries as follows: Brazil – 1.28 EUR/kg, Canada – 1.21 EUR/kg, Denmark – 1.53 EUR/kg, France – 1.56 EUR/kg, Spain – 1.49 EUR/kg and on average across the EU 1.67 EUR/kg of live pigs. These data confirm different cost competitiveness of individual countries. The cited non-European countries, in particular Canada and Brazil have lower costs than the leading producers of live pigs in Europe. The main production costs of live pigs are undoubtedly feed costs. Figure 8 shows the share of feed costs in the production costs of live pigs in selected EU countries. These data confirm very large differences in this ratio between

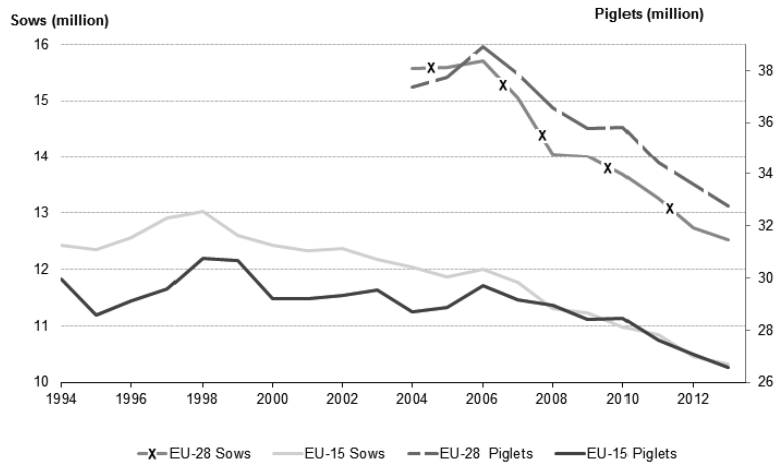


Figure 8. Total domestic production of pork (quarterly) – meat production in the period 1994–2012
Source: Eurostat.

the above-mentioned countries. The highest share of feed costs in total costs was recorded in Ireland and Belgium. Whereas the highest share of this group of costs in the production costs of live pigs occurred in the Netherlands and Greece, and slightly higher in Denmark and France.

PRICES OF LIVE PIGS

Profitability of the live pig production is determined not only by the costs of production but also by the prices of live pigs. Figure 9 shows the evolution of prices of live pigs in the European Union, Brazil, Canada and the United States in the years 2005–2016.

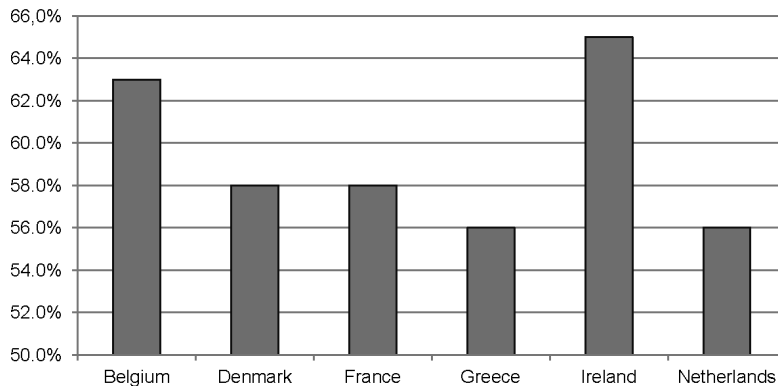


Figure 9. The share of feed costs in the production costs of live pigs in selected EU countries in 2013
Source: Eurostat.

This figure confirms the phenomenon of live pigs price variation as well as the existence of price differences between countries selected for comparison. The European Union is generally characterized by higher prices of live pigs than in the compared countries. The lowest prices were listed in Canada and Brazil. It should

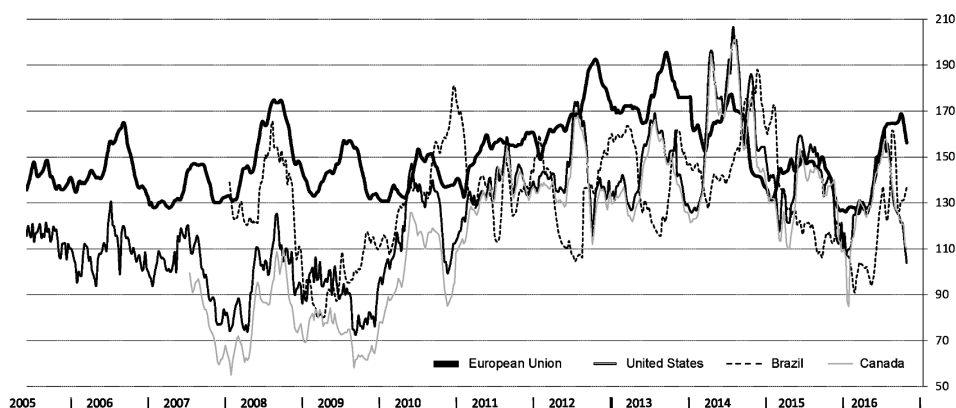


Figure 10. Prices of live pigs in the years 2005–2016 in EUR/100 kg (the EU, Brazil, Canada, the USA)

Source: Meat Market Observatory – Pig. Retrieved from: <https://ec.europa.eu/.../market-observatory/meat/pigmeat/statistics> (Access: 07.11.2016).

Table 4. Prices of live pigs in the EU, November 2016

Country	Hog prices	
	EUR/kg	PLN/kg
Austria	1.57	6.97
Czech Republic	1.56	6.93
Denmark	1.42	6.30
France	1.44	6.39
Spain	1.47	6.53
Netherlands	1.35	5.99
Lithuania	1.54	6.84
Germany	1.56	6.93
Poland	1.50	6.66
Portugal	1.57	6.97
Romania	1.60	7.10
Sweden	1.76	7.81
Slovakia	1.62	7.19
Hungary	1.58	7.02
Italy	2.00	8.88
UK	1.63	7.24

Reference prices: pigs – EUR/kg of chilled carcass weight Class E; cattle – EUR/kg of chilled carcass weight Class R3 (1 EUR = 4.44 PLN – exchange rate of 17.11.2016).

Source: Rynki [2016].

be noted, however, that over the last few years the observed variation in prices was lower than before 2010 when the prices in the EU were much higher than in the countries selected for comparisons. Variations in prices of live pigs occurred not only between these countries. The phenomenon of live pig price variations can also be found among the EU Member States (Table 4).

The data presented in Table 4 show that the lowest prices of live pigs occurred in such countries, as: the Netherlands, Denmark, France and Spain, whereas the highest prices of pork were recorded in Italy, Sweden, the UK, Slovakia and Romania. Poland is in the EU zone of average prices of live pigs [Szymańska 2008].

PROSPECTS FOR THE DEVELOPMENT OF THE GLOBAL LIVE PIG MARKET

The situation in the global pork market will be influenced by the world's major producers. Dargiewicz estimates [2016], that China will have difficulties to increase their supply of pork production for some time. The country's import growth 2016 YTD was 82%. The main source of imports is the European Union whose share in the structure of imports is over 60% and the USA with about 20%. In the years 2016–2017 the pig population in China is projected to gradually recover, and that mainly through the development of modern production systems. Although, as expected, development of these production systems will be somehow hampered by stringent environmental regulations. Hence, it is assumed that in the long term, China will have to import between 1–3% of its pork consumption and its meat products. The USA – according to Dargiewicz's estimates [2016] – may in the long term become a leader in the global pork market. This will be favored by lower than in the EU cost of live pig production and increasing export opportunities. To grow up, the export requires the development of live pig production and at the same time development of processing facilities through the construction of new modern processing plants. Only under these conditions – in view of the stagnant domestic demand for pork meat and its products – development of this sector in the US will be possible. The EU's surplus of pork production over the domestic demand is 10–15%. Following the Russian embargo EU countries channelled their exports mainly to Asian markets. Production in the EU is based on efficient production systems which can ensure improved fertility of sows and therefore a greater number of fattening pigs from one sow. This should somewhat offset the feed costs which are higher than in the US. The USA, for its part, will certainly strive to eliminate tariffs on trade with the European Union as

currently the pork from the European Union can be freely exported to the US while exports from the US are charged 30% customs duty rates [Dargiewicz 2016]. An important role in the global live pig market can also have Canada and Brazil with low production costs of live pigs.

PROSPECTS FOR THE POLISH SECTOR OF LIVE PIGS

The European Union has a single meat market. This means that Polish pig producers have to compete primarily with the producers from the EU countries, in particular with Denmark, the Netherlands, Germany or Belgium. Producers from these countries have competitive advantages in comparison to their Polish counterparts. These result from a larger production scale, higher efficiency of the breeding sector and better conversion of feed into livestock, and in turn form lower production costs. An important advantage of producers from the above cited EU countries is a better organization of supply chains which consists of closer relations between the producers of live pigs, processing plants and traders. In Poland, there are still certain difficulties with improving organizational links on individual stages of supply chains. The predominance of small producers is a serious obstacle to the development of pig farming and pork processing. Hence the “old” EU Member States strengthen their competitive advantage in relation to the new EU members, including Poland. In addition, a characteristic feature of Polish pork market is high imports of unprocessed meat. Polish domestic production in 2015 hit almost 2 million tons (1973 thousand tons), and imports of meat to Poland in the same year amounted to 676 thousand tons. For the situation in the domestic live pig market to improve, it is necessary to increase the concentration of the pig population both at the stage of piglet production and in pig fattening. Although it seems a common knowledge, the process of concentration of the pig population is rather slow. This is partly associated with the existing organizational and legal difficulties. The construction of new large farms raises not only local public outcry, but is also hindered by the construction procedures. In addition, it is also necessary to further improve the efficiency of the production of live pigs and strengthen cooperation between processing plants and farmers. It should be noted that in a situation of low prices and a decline in the profitability of production it will be difficult for the pig farming in Poland to develop.

CONCLUSIONS

1. A worldwide growing number of pig population is accompanied by a decreasing number of producers. This shows the evidence of the ongoing processes of concentration of pig inventory and the increase in the scale of pig farming. Such

development allows for using the economies of scale for reducing production costs.

2. The world market and the EU market of pig production keep differentiating. Next to the countries with the downward trends in the live pig inventory and production there are countries that increase their production volumes. In the European Union the volume of live pig production in the old EU Member States keeps increasing, while in the newly admitted EU countries it faces reduction. This resulted mainly from the differences in the level of concentration of pig population and from biological and organizational advancement in individual countries, and consequently from livestock productivity and production efficiency.
3. Different levels of production costs in individual countries will lead to further movement of the pig population from the countries with higher production costs to those that are able to produce pig livestock at a lower cost. Introduction of modern production technologies in the technologically “backward” countries can limit the scale of this “flow” of pig farming both in a global and European level. For this purpose it is necessary to implement innovative technologies of farming pigs.
4. Livestock prices vary between countries both globally and in the European Union. Low prices of live pigs can be found in Canada and Brazil, and across the EU in the Netherlands, Denmark, France and Spain. In other EU countries prices are higher, and they hit the top in Italy.
5. The liberalization of trade with the USA and Canada may slightly weaken the competitive advantages of EU producers but it is not necessarily inescapable. European producers have not yet exhausted all the possibilities of improving the efficiency of their pig farming and reducing production costs.
6. The development of pig farming and production of live pigs in Poland faces a number of barriers. In addition to a low scale of production and, on average, fairly low economic efficiency, there are obstacles in the form of limitations on building large modern farms and weak organizational links between various operators in the supply chains of the live pig market.

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DIFFICULT SITUATION IN THE PORK MARKET IN POLAND – REASONS AND PROPOSED SOLUTIONS

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Abstract. The aim of the study was therefore to identify the causes of this difficult situation in the Polish pork market and to indicate possible improvements. The research showed that slaughter and processing of pork find the situation in this market even worse than the producers of live pigs. In their view, it is essential to enhance the promotion of the pork meat consumption, limit imports of pork and strive to reduce production costs of pork, as they determine the purchase price of raw material for the production, which affects the operating costs of companies. In opinion of live pigs producers the most important measures to change this situation are: limiting imports of pork, looking for new outlets, increasing the intervention of the State and the reduction of production costs in order to increase competitiveness on the European and global markets. The least fruitful for the improvement of the economic situation in the market of live pigs and pork according to the farmers and undertakings is the integration in the supply chain.

Key words: pork market costs, integration, supply chain

INTRODUCTION

Pork is one of the most important types of meat that is consumed in the world. In 2015, its share in the global meat production amounted to 36.8%. In subsequent years its importance will be decreased due to the increase in the share of poultry meat whose share in the same year amounted to 35.2%. In Poland in 2014 the average consumption of pork was 41.7 kg per person, and its share in meat consumption accounted for 55.9%.

Pigs, like cattle, are the most important species of farm animals. According to the Central Statistical Office of Poland, in 2014 their share in the structure of global agricultural production amounted to 10.6% and to 14.1% in commercial production. Whereas in livestock production, pigs accounted for 21.6% of global production and 23.8% of commercial production [Rocznik... 2015]. Poland is also one of the major pork producers in the European Union, although its importance in this market gradually decreases. In 2010, its share was 8.9% and in 2013 – 7.6%. In terms of the pig

inventory and production of live pigs Poland is ranked 4th in the EU, after Germany, Spain and France.

In the years 2006–2015 the pig inventory decreased from 18.9 million to 11.6 million units [Rynek mięsa... 2015]. As a result of unprofitability of this production many operators have given up pig farming. In 2011 more than 359 thousand agricultural holdings were engaged in raising this animal species, i.e. 9.5% less than the year before. In 2012 the number of pig farms dropped to around 260.1 thousand. In 2015, the pig farming situation was so critical that not only small but also medium-sized farms abandoned it. In June 2015 in pig farming were engaged 22% fewer farms than a year earlier. Simultaneously, in 2018 Poland shift from pork exports to pork net imports, and this situation persists. In years 2008–2014, live pig imports increased from 1 134.6 to 5 558.8 thousand pig units while the import of pork in the chilled carcass weight rose to 822.1 thousand. The aim of the study was therefore to identify the causes of this difficult situation in the Polish pork market and to indicate possible improvements.

MATERIAL AND METHODS

The data analysis included the studies of Polish and foreign reference books and the data storage statistics from the Central Statistical Office of Poland, the Ministry of Agriculture and Rural Development and the General Veterinary Inspectorate of Poland. The primary source of data was the research carried out in the group of 110 pig farms and 60 companies involved in the slaughter and processing of pork.

The research in pig farms was carried out in 2014. As farm selection criteria, it was adopted what follows:

- rearing at least 10 sows in a farm or selling 200 fattening pigs a year;
- a farm specialising in live pig raising, which fact was determined basing on the share of live pigs in the revenues from sales and it being at a minimum of 60%;
- a farmer's consent to participate in the research,

At the first stage of the study all provinces in the country were taken into account and the Agricultural Advisory Centre was addressed with a request to identify 10 agricultural holdings in each of the provinces that meet the adopted criteria. However, prompt was the farms identification, due to a limited number of suitable farms or the farmer's refusal to fill out the questionnaire, the study could not cover Świętokrzyskie and Lesser Poland provinces. What is more, some remaining provinces provided for the data from a smaller number of farms than it had been expect-

ed. Eventually, it was the employees of the Agricultural Advisory Centres who filled in the questionnaires carrying an interview in 110 pig farms in the country.

The meat companies were surveyed in 2015. With respect to the companies the following selection criteria were adopted:

- slaughtering of pigs and/or processing of pork;
- the owner's consent to fill in the questionnaire.

In the first stage, the survey was sent electronically to 110 meat companies. Due to data protection and reluctance of the undertakings to provide information only by 5 entities returned completed questionnaires. In this situation, still using a questionnaire method, the owners of the meat companies were approached directly. Eventually, as many as 60 companies completed the surveys. The surveyed companies were partially different in terms of their business activities, the scale of production and the number of employees. Their diversity, however, reflects in overall the structure of business entities in the pork market. The results of the analyses have been presented in a narrative and graphic forms.

The analysis also uses the results of the research carried out in 134 farms producing live pigs in 2013. The data from these farms was acquired by the Institute of Agricultural and Food Economics – National Research Institute as part of the surveys within Agricultural Products Data Collection System AGROKOSZTY. Based on the actual data from these farms for previous years, the IERiGŻ-PIB (Institute of Agricultural and Food Economics – National Research Institute) conducted the simulation calculations on the economic results of farms producing pig livestock in 2014–2015.

THE REASONS FOR A DIFFICULT SITUATION IN THE PORK MARKET IN POLAND

The reference books point out to the many reasons for a difficult economic situation in the pork market in Poland. Among the causes of the decline of the pig population Pejsak [2012] indicated:

- archaic structure of agricultural holdings, that is a many of small farms at the time of the Polish accession to the EU and unequal chances of Polish producers of pigs in comparison with their counterparts in the EU-15;
- low profitability of production associated with high grain prices and consequently of feed;
- unsatisfactory level of vocational training of a significant percentage of young farmers expected to take over the farms;
- significant negligence attributable to the broadly understood state;

- negligence on the part of pig producers and farmers;
- low activity of agricultural chambers and associations and unions operating in the agriculture in favour of pig producers and farmers;
- bad policies of meat plants;
- lack of equity or other funds for renovation and modernization of pig farms;
- typical of Homo sapiens desire for comfortable life.

A team of experts, who in 2013 prepared a strategy for the reconstruction and development of pig production in Poland before 2030 aimed at improving the functioning of the pork production sector, listed the following causes of poor live pig market conditions [Blicharski and Hammermeister 2013]:

- fragmentation of breeding, farming and of slaughterhouses;
- relatively low production efficiency;
- unfavourable legislation for the concentration of pig production;
- high capital in comparison with EU countries;
- the lack of mechanisms to prevent excessive price fluctuations; disapproval and excessive bureaucracy in all government departments towards pig production.

In 2015, the National Council of Agricultural Chambers¹ when taking a position on the current situation in the pork market expressed its conviction that the reasons for a difficult situation in the pork market include irregularities in the management and settlement of the production in the contract system. This system consists in farmers providing specific services for processing plants producing feed and other agricultural inputs. Under the contract, the farmer receives the necessary agricultural inputs such as piglets or weaners, feed additives and medicines. Wherein the young animals are usually imported and under the IRZ system (The Animal Identification and Registration System) they are assigned to the farmer, although they are owned by the company ordering the service. For their part, farmers provide the buildings necessary for the rearing and their own work for which they receive flat rate fees, depending on the economic effects measured by the cost of producing 1 kg of pork. Such remuneration does not include the purchase prices of produced fattening pigs.

The decline in the purchase prices is also significantly affected by the content of the messages released by the World Health Organization (WHO) about the alleged dangers of red meat for human health. For instance in October 2015 an international team of experts said that eating processed red meat contributes to the development of cancer in the human body [Q&A... 2016]. Such information contributes to the reduction of the consumption of this kind of meat.

¹ <http://www.krir.pl/2014-01-03-03-25-21/prace-w-komisjach-sejmowych/3971-opinia-na-temat-aktualnej-sytuacji-na-rynku-wieprzowiny> (Access: 18.09.2016).

According to the local agricultural authorities of some importance is also the wrong attitude of the representatives of the processing sector which leads to the reduction in the purchase prices of pork in the pre-holiday period. At that time, there is an increased demand for meat and meat products, therefore processing plants, with guaranteed sales of their products, often buy raw material as stock but offer low prices.

In 2016 Blicharski pointed out to the occurrences of ASF in wild boars and pigs as the main problem of the industry, these being found in several districts of Podlaskie, Mazowieckie and Lublin provinces [Blicharski 2016]. These occurrences led to the embargo on Polish pork introduced by such countries as Russia, Ukraine, Belarus, China, Japan, South Korea and Taiwan. Especially difficult was the ban on exports to the Russian market, for back in 2013 Russia was one of the main outlets. At the same time, due to the increasing supply of meat on the European markets, there was a decline in the price of pork.

According to Blicharski [2016], a separate problem is the structure of domestic pig herds. Production of pork is profitable on a large scale, whereas in Poland it is still dominated by small-and medium-sized farms. Farms with over 500 pigs account for only 1% of all holdings raising pigs. Another problem is also an increasing competition from poultry meat, which is cheap, easily accessible and simple to prepare. Its consumption has recently been increasing steadily, and soon the consumption of poultry meat is likely to exceed the consumption of pork.

RESEARCH RESULTS

The survey was also addressed to the producers of pigs and meat companies representatives, who were asked to assess the economic situation in the market of live pigs and pork. The first of these two groups expressed their opinion in 2014 and the second one in 2015. During this period, the economic situation was prejudicial for the pork producers. As a result of the deepening decline in the prices of pigs and the progressive reduction in the population of this species pig farming became less and less profitable. The pig inventory in the individual farms in 2015 decreased by 6% to 10 590.2 thousand units, when compared to 2014. Reduced was also the number of all technological groups of pigs. At the same time the price situation in the sale of live pigs has deteriorated. The average purchase price of fattening pigs was 4.30 PLN/kg and was lower by 10.8% compared with the previous year. The reduction in prices contributed to a decline in the profitability of production. The research carried out by the staff of the Institute of Agricultural and Food Economics – National Research Institute in the group of 134 farms raising pigs shows that in 2014–2015

the lowest profitability was found among the farms with the smallest production scale. In the case of large scale productions the profitability index was much higher and in 2014 amounted to 92.1% to go down to 88.3% next year (Fig. 1). Concurrently, throughout the analysed period, the production of pork remained below the threshold of profitability.

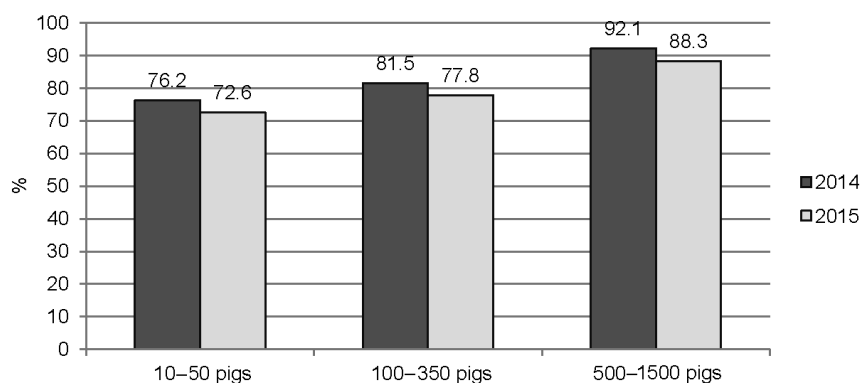


Figure 1. Profitability of the gross production of live pigs in the years 2014–2015
Source: Żekała [2016].

In all identified groups of agricultural holdings the income from gross production of live pigs, calculated without subsidies and as per 1 hour of work of the farmer and his family, was negative, which means that this work was not payable (Fig. 2). In 2015 the situation only deteriorated and the volume of the loss incurred by producers of live pigs increased. The biggest loss was in the farms with the largest production scale.

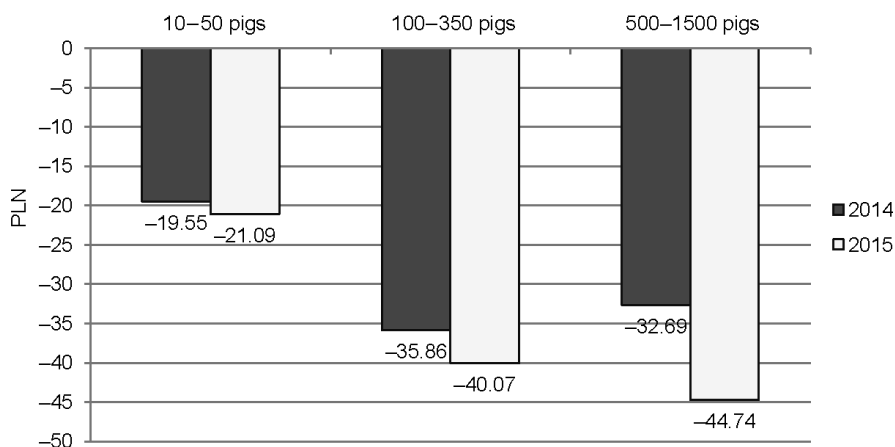


Figure 2. Income from the gross production of live pigs without subsidies per 1 hour of work of the farmer and his family in the years 2014–2015
Source: Żekała [2016].

In the group of live pig producers studied by the author up to 48.3% of the farmers judged the situation in the pig market as moderate, 30% as bad, and 16.7% as very bad (Fig. 3). Only 3.3% of farmers gave it a good mark.

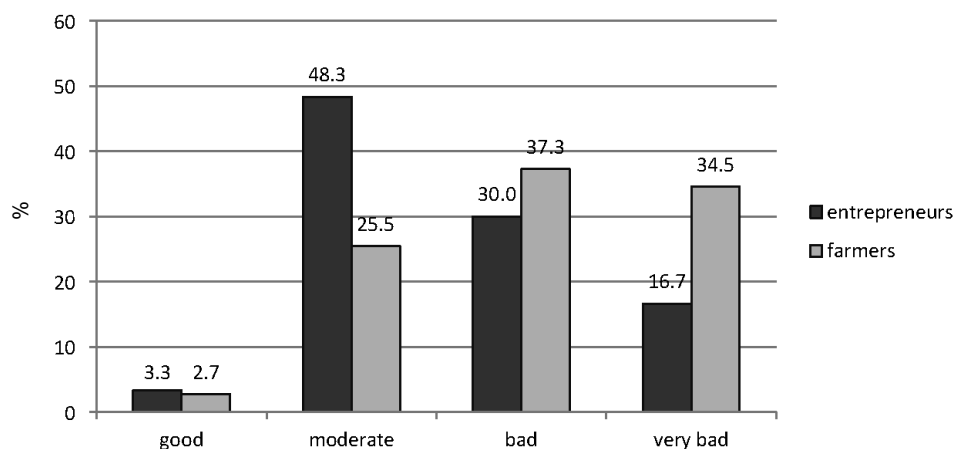


Figure 3. Assessment of the economic situation in the market of live pigs and pork in the opinion of farmers and undertakings in the years 2014–2015

Source: own study.

The undertakings' assessment was even lower. More than 1/4 of them rated the economic conditions in the pork market as moderate, 37.3% rated them as bad, and 34.5% as very poor. Only 2.7 of the surveyed undertakings rated the situation in the pork market as good. There were no very good ratings for the operations of this market.

Given such low ratings the respondents were asked about the ways to improve the economic situation in the live pig market (Fig. 4). The vast majority of farmers found it necessary to start with limiting the imports of pork (78.2%). In the second place they most often pointed to the need for new outlets to increase exports (57.3%). A large percentage of farmers considered that an increased intervention of the State would be fruitful to improve the economic situation in the market (54.5%). In their view, the market mechanism alone can not protect against the crisis in this market. Approximately 45.5% of live pig producers also considered necessary to reduce production costs in order to increase competitiveness on the European and global market. Essential step for the farmers was also the introduction of subsidies for the production of piglets (30.9%). In their view, this will help to increase the production of piglets on a large scale as the farms specializing in fattening will limit imports of young animals and increase fattening of piglets from domestic production. The pro-

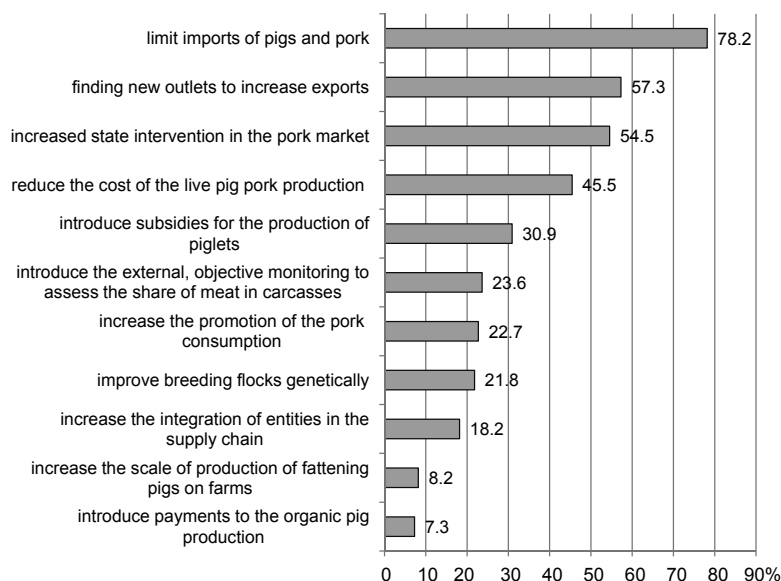


Figure 4. Ways of improving the economic situation in the live pig market in Poland, in the opinion of farmers

Source: own study.

ducers of live pigs find it also important to introduce external, objective inspections to evaluate the share of meat in carcasses (23.6%), which reveals their distrust in the evaluation currently effectuated by the slaughterhouses operators. The surveyed respondents found it also significant to increase the promotion of the consumption of pork (22.7) and improve genetic material of the raised herds (21.8%). A smaller percentage of farmers pointed to the need for increasing the integration (links) between the operators in the pork supply chain (18.2%). In turn, they considered less important the increase in the production scale of fattening pigs on farms (8.2%) and the introduction of subsidies for organic production of pigs (7.3%).

Suggestions made by undertakings on how to improve the economic situation in the pork market varied considerably compared with the responds provided by the producers of live pigs (Fig. 5). According to operators involved in the slaughtering of pigs and pork processing, it is of primarily importance to increase the promotion of the consumption of pork. This solution was indicated by 2/3 of the respondents in this group. This is a reasonable approach for the increase in the consumption of this kind of meat directly contributes to the increase in sales which generates revenue for the companies. According to the undertakings and similarly to the farmers' believes, it is also important to reduce imports of pork. Such actions were in favour of 63.3% of the surveyed undertakings. In addition, half of the respondents in this group indi-

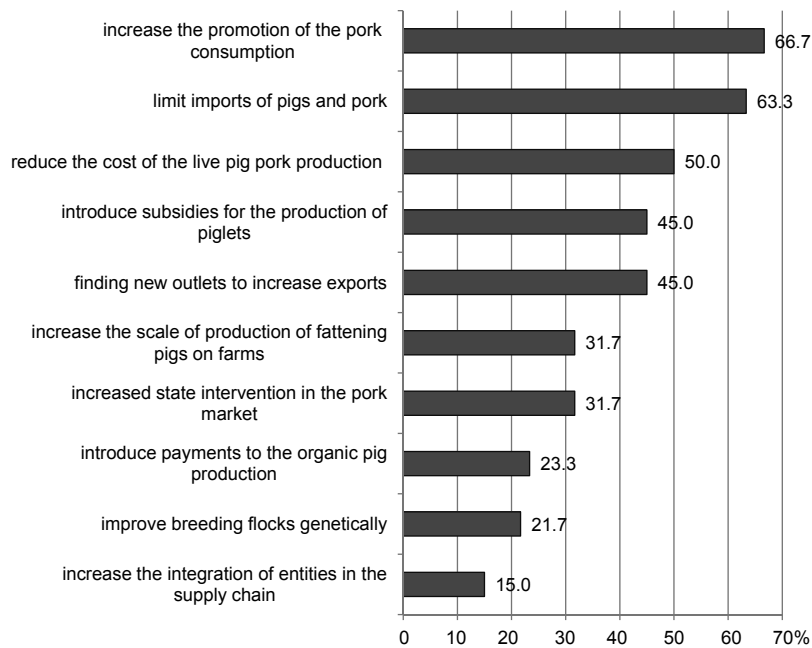


Figure 5. Ways of improving the economic situation in the live pig market in Poland, in the opinion of entrepreneurs
Source: own study.

cated that efforts should be made to reduce the production costs of live pigs because they determine the purchase price of pigs, that is affect the operating costs of companies involved in the slaughtering of pigs and pork processing. One of the important ways to improve the economic situation in the pork market as the undertakings see it is finding new outlets to increase exports (45.0%) and subsidies for the production of piglets (45.0%). Almost 1/3 of the respondents in this group said that it is necessary to increase the scale of production of fattening pigs on farms and to provide greater protection for the market by the State. In their view, a greater scale of production will allow for the acquisition of larger batches of fattening pigs with similar qualitative characteristics, which will facilitate pork processing. The intervention of the State is considered necessary especially in crisis situations as the free market does not always work in this sector. In view of some undertakings there should be also introduced subsidies for organic production of pigs (23.3%) and improved genetic material of raised herds (21.7%). Only 15.0% of respondents indicated the need for integration in the supply chain of pork.

According to the local agriculture authorities for the economic situation in the pork market to be improved it is advisable to intensify the works on the EU forum in

order to run intervention mechanisms in the pork market, make the earliest possible recovery of Polish pig herds from the African swine fever virus and reduce the negative economic consequences for pig producers. Pursuing these goals is possible by:

- considerable reduction in the population of wild boars;
- immediate buyout of pigs in farms located in Podlaskie voivodeship (zone at risk) which do not comply with the rules of biosafety programme and quick compensation for the withdrawal of production in three years.

According to the National Council of Agricultural Chambers², it is also indispensable to sort out with help of legal regulations the turnover of weaners and the contract system by:

- obligating any company producing in the contract system to register the herd under their own number, not the number of the farmer;
- the start-up of veterinary services to carry out a full veterinary inspection of imported piglets and weaners;
- explaining the reasons for the differences between the prices of German or Danish pork on the stock markets in the EU and those of the carcasses imported to Poland.

According to the local agriculture authorities, it is also important to:

- introduce regulations that would oblige the processing and purchasing plants to contract the pigs supply;
- finalise long-term works and adopt regulations permitting direct sales of processed products from the very farms, including meat products;
- open under the RDP 2015–2020 the measures for the so-called small processing and small local slaughterhouses.

In view of various problems in the pork market, at the beginning of August 2016 the Ministry of Agriculture and Rural Development presented a draft version of a long-announced Programme for the Development of Major Agricultural Markets in Poland. The programme includes the project for the development of pork market in the country.

The main objectives of the programme are:

- the development of pig production on the basis of existing resources;
- improvement of the competitiveness of domestic production of pigs in the EU market (through consolidation of smaller farms and reduction of production costs);
- stabilization of the national sector incomes.

² <http://www.izbarolnicza.pl/index.php/102-news/559-stanowisko-samorzadu-rolniczego-w-sprawie-trudnej-sytuacji-na-rynkach-rolnych> (Access: 19.09.2016).

As the most important challenges for the domestic sector of live pig production the programme listed:

- improving cooperation within the marketing chain (in particular the consolidation of livestock producers);
- adjusting the scale, structure and efficiency of production to market requirements (improving production rates and genetic parameters of livestock);
- addressing consumers with an apt message about pork meat;
- proper implementation of the instruments of the common organization of agricultural markets;
- developing solutions for small and medium-sized farms (farming in an alternative system, aimed at generating a higher added value);
- the use of income stabilizing measures (agricultural income stabilization fund, futures).

The programme also includes indicators of achievement, such as:

- the increase of domestic pig population by at least 20–30%;
- the increase in exports of pork meat by at least 15%;
- the increase in the share of pork produced by producer groups, organizations and agricultural cooperatives to 30%;
- an increase of at least 80% of live pigs marketed under the contracts for the delivery of agricultural products.

CONCLUSIONS

This research does not cover all the issues related to the difficult situation in the market of live pigs and pork. However, some conclusions can be made on their basis.

1. There are several reasons for a difficult economic situation in the pork market, which underlines the complexity of the problem and its being multifaceted. Different researchers usually point to the fragmented structure of pig farming, low profitability of the production associated with high grain prices, expensive investment capital and the lack of adequate intervention by the State.
2. In the years 2014–2015 the unprofitability of pig farming was strongly determined by a deepening decline in purchase prices of live pigs and a progressive reduction of population of this species. A further hindrance was the detection of African swine fever in the country, which resulted in the imposition of embargo on Polish pork by such countries as Russia, Ukraine, Belarus, China, Japan and Korea.

3. The producers of live pigs are aware of the difficult economic situation in this market. In their opinion the most important measures to change this situation are: limiting imports of pork, looking for new outlets, increasing the intervention of the State and the reduction of production costs in order to increase competitiveness on the European and global markets.
4. The undertakings involved in the slaughter and processing of pork find the situation in this market even worse than the producers of live pigs. In their view, it is essential to enhance the promotion of the pork meat consumption, limit imports of pork and strive to reduce production costs of pork, as they determine the purchase price of raw material for the production, which affects the operating costs of companies.
5. The least fruitful for the improvement of the economic situation in the market of live pigs and pork according to the farmers and undertakings is the integration in the supply chain, although the integration ties in the EU countries with the largest pork production are at a very high level. The need of contracting the supplies is, however, recognised by local agriculture and state authorities.
6. In order to improve the economic situation of producers of live pigs, slaughterhouses and meat plants state authorities undertake specific actions. In 2016, the Ministry of Agriculture and Rural Development prepared a programme that envisages development of production of live pigs based on existing resources, improvement of competitiveness of domestic production of pigs in the EU market and stabilization of the national sector income.

Acknowledgements

The project was funded by the National Science Centre on the basis of decision DEC-2013/09/B/HS4/03606.

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SUSTAINABILITY AND CORPORATE SOCIAL RESPONSIBILITY IN FARMS' STRATEGIES: A CASE STUDY OF PIG FARM IN UKRAINE

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Abstract. Many sustainability studies of animal husbandry consider the economic, environmental and social aspects. Farmers and scientists tend to put most emphasis on the economic and largely ignored the environmental and social aspects. The objective of the present study is therefore to gain further insights into corporate social responsibility (CSR) of pig production. Corporate social responsibility is considered as a way for farms to increase its reputation and safeguard against risks including food safety, environmental or social incidence. Thus, it is not surprising that CSR has gained importance for meat companies. However, the question arises whether consumers are indeed aware and appreciative of this involvement. Many citizens may not know what contemporary pig production actually entails. This paper seeks to address these issues. This article examines quantitatively the determinants of purchase decisions based on corporate social responsibility (CSR), adopting a hierarchical conceptual model of decision-making where the key factors are personal concern, information availability and financial considerations.

Key words: sustainability, pig production, corporate social responsibility, ecosystem

INTRODUCTION

Over the last few years, sustainability has become a new mega trend and even a business imperative [Lubin and Esty 2010]. It has also become the key driver for innovation [Nidumolu et al. 2009] and Cargill President and Chief Executive Officer Dave MacLennan declared that sustainability is even the new “normal” [Cargill 2015]. Sustainability related risks and opportunities become standard elements in the non-financial reporting of stock-listed US meat companies [SASB 2015].

Society places new expectations on farming nowadays. Farmers have other responsibilities beyond simply making profit. From a corporate social responsibility (CSR) point of view, farming should also cope with social concerns, such as environmental issues and animal welfare aspects. In the last few years, a lot of these expectations are translated into norms, e.g. the more animal friendly group-housing for pig

production will be obliged. As a consequence, management decisions in farming, in particular with respect to innovations (new technologies or farming systems), must not only take into account production improvements, but also social and environmental effects [Boogaard et al. 2011].

This study has tended to focus on Ukrainian farms that produce pig to embody corporate social responsibility and sustainability in their strategies. The scope of this research is to identify and illustrate the main CSR practices adopted by farms operating in the livestock sector in Ukraine, and analyzing their CSR and sustainability strategies. In addition, this study presents how the largest Ukrainian farms of pig production organize their sustainability and CSR strategies, and how they communicate these concepts. Another objective of this study is to support farms with actions to improve their strategies in a sustainable way.

The fundamental research questions guiding the study and literature review is the following: How farms operating in the livestock sector organize sustainability and corporate social responsibility (CSR) in their strategies? Aiming at creating a more comprehensive picture about the research topic, the following sub-questions are also reviewed to further guide the research process:

1. Are there specific sustainable strategies or specific actions that Greek dairy companies follow in order to deal with these issues?
2. Are these strategies the same for all the typologies of companies, or do they vary between large and small and medium enterprises (SMEs)?
3. What are the main communication and marketing strategies followed by these companies in order to inform consumers, citizens, and private investors about their sustainability and CSR initiatives?

METHODS

Literature review

Corporate social responsibility is one of the major issues, at a time when crises both in economic terms and in a climatic level, form a challenge [EDC n.d.]. It is also mentioned that “Corporate Social Responsibility is becoming increasingly important to justify business practices to society in general and to stakeholders specifically” [Ingenbleek et al. 2007].

The definition that European Commission gives to the corporate social responsibility concept is that: “Corporate social responsibility is a multi-stakeholder concept. Facilitating dialogue between stakeholders is an important part of the Commission’s policy on CSR” [EC 2014].

In addition, according to the Export Development Canada (EDC) CSR framework established in the period 2003–2004, the period 2009–2010 were addressed the CSR strategic priorities about climate change, human rights and transparency while the environmental and social risk management were introduced [EDC n.d.].

The nature of CSR remains complex. Although, the term of CSR is known worldwide, diversity in cultural issues, developmental level of each country and priorities in different regions forming the term of CSR, which is adjusted in each case. However, in all the cases, the term of CSR should enclose the voluntary nature that CSR supports, the interdependence relation to sustainable development and above all the importance that given by the undertakings when they decide to integrate CSR in their strategy [CSR Hellas 2011].

The case study

According to the Association of Pig Producers of Ukraine, Top-10 ranking by the presence of pigs:

1. APK-Invest – 21 926 pigs. The company provides 18% of pork industrial production.
2. Globino Pig Breeding Complex – 12 642 pigs.
3. Danosha – 12 320 pigs.
4. AGROPRODSERVIS – 12 000 pigs.
5. Agri-Plant Slobozhanskiy – 8 500 pigs.
6. Nyva Pereyaslovshchyny – 8 409 pigs.
7. Joint Stock Company “Bahmutskiy Agrarian Union” – 7 135 pigs.
8. Agroindustrial company – 6 711 pigs.
9. Agricultural Complex “Kalita” – 5 500 pigs.
10. Barkom – 4 852 pigs.

Data

Statistical information for the survey is a database of the State Statistics Service of Ukraine and the international database of Food and Agriculture Organization of the United Nations.

RESULT AND DISCUSSION

Pork consumption is increasing in the world and in average is 12.57 kg per person. China is the leader of product consumption – 31.28 kg per person [Shpychak et al. 2015].

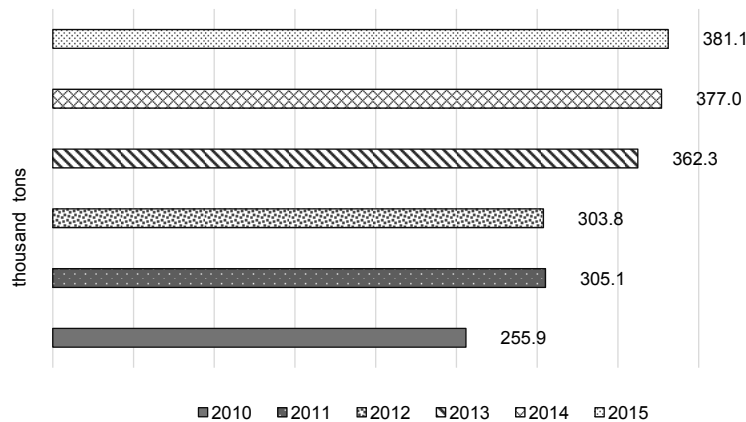


Figure 1. Pork production by agricultural enterprises in Ukraine 2010–2015

Since the social impact hypothesis arises from the CSR multi-stakeholder perspective, we have considered a CSR measure which gathers items grouped around four key stakeholders [Turker 2009, Battaglia et al. 2014, Turyakira et al. 2014]: environment, employees, society and customers. Specifically, the scale of Lechuga [2012] was chosen as an instrument for measuring the CSR. The author developed and validated a measuring instrument according to the psychometric theory of scales validation. In her study, 57 CSR practices were grouped into six stakeholder categories (employees, customers, suppliers, environment, local community and corporate governance). The author designed and validated a final scale composed of 24 items, grouped into four key stakeholder categories (environment, employees, customers and local community), as specified in Table 1.

Based on the expert evaluation of CSR of the largest producers of pork was made graphical model of its results (Fig. 2). The analysis of the results of the evaluation of pig producers' CSR shows that Danosha and Nyva Pereyaslovshchyny are leaders in CSR.

Danosha sets new standards for sustainable pig production in Ukraine. Close dialogue with the local community about odour emissions is crucial for the operation of the company. A new biogas plant reduces odour and carbon emissions significantly. Danosha operates an advanced pig production in Ukraine with 600 employees. When the company applies the organic waste from pig farms as fertilizer, the smell cannot completely be avoided. It is therefore important that Danosha has a good dialogue with the local community about how the application can be planned in order to bother the neighbors as little as possible.

Table 1. CSR practices in pig producers

<i>Indicate your level of agreement with the following statements about environmental practices (1 = strongly disagree, 5 = strongly agree)</i>	
En.Pr.1	Minimize the environmental impact of your business activities
En.Pr.2	Design products and packaging that can be re-used repaired or recycled
En.Pr.3	Goes voluntarily beyond legal environmental regulations
En.Pr.4	Regularly conducts environmental audits
En.Pr.5	Reuses and recycles materials
En.Pr.6	Adopts measures for ecological design in product/services
En.Pr.7	Implement programs for the use of alternative energy
En.Pr.8	Implement programs to reduce water consumption
En.Pr.9	Makes energy – saving investments
<i>Indicate your level of agreement with the following statements about practices related to employees (1 = strongly disagree, 5 = strongly agree)</i>	
Em.Pr.1	Employees' interests are taken into account in company decision-making
Em.Pr.2	Support employees who wish to continue or upgrade their education/training
Em.Pr.3	Help the employees find suitable work/life balance (flexible working hours)
Em.Pr.4	Recognizes the importance of stable employment for your employees and society (in the local area)
Em.Pr.5	Develop/implement regular training programs
Em.Pr.6	Assess employees work/labor environment on a regular basis
<i>Indicate your level of agreement with the following statements about practices related to local community (1 = strongly disagree, 5 = strongly agree)</i>	
S.Pr.1	Incorporates/includes local community interests in company decision making
S.Pr.2	Support sports or cultural activities in the local community
S.Pr.3	Maintain clear relations with local government authorities
S.Pr.4	The business considers itself to be part of the local community and therefore care about its development/local impact or the improvement of the local infrastructure
S.Pr.5	Support programs for the disadvantaged
<i>Indicate your level of agreement with the following statements about practices related to customers (1 = strongly disagree, 5 = strongly agree)</i>	
C.Pr.1	Meets its commitments with quality and fair price
C.Pr.2	Inform customers about the proper use of their products and warnings of potential risks
C.Pr.3	Take measures to prevent customer complaints
C.Pr.4	Respond to customer complaints or inquiries

Source: Lechuga [2012].

It takes both time and patience to establish a good dialogue. The experience shows that it saves the company for much trouble. Danosha has – among other things – participated in several meetings in the village hall, and if complaints about smells arise, a representative from the management immediately sets out to find the source together with the complainants.

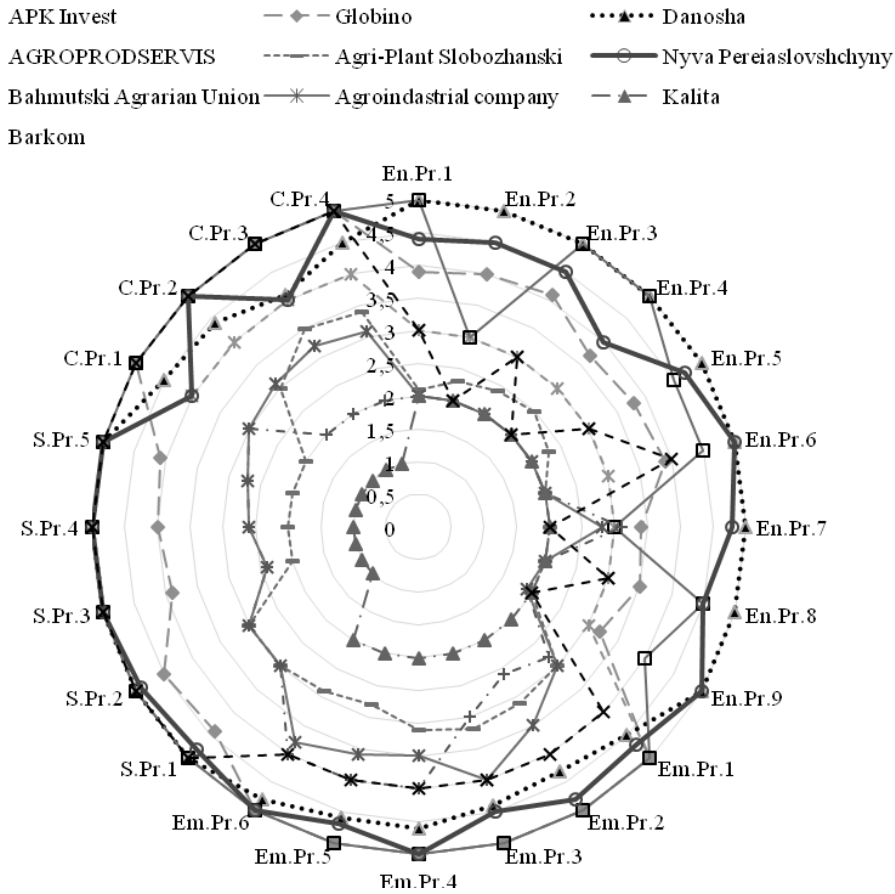


Figure 2. Evaluation result of CSR of pig producers of Ukraine
Source: own elaboration.

Nyva Pereyaslovshchyny are safe for the environment, modern, fully mechanized and automated: all sections of pig feed with automatic feeding system from Skioold Transpork; water system Aqua Level; heating, ventilation and cooling, controlled Skov Computer peripherals; spray systems and wetting. On pig farms discharge industrial wastewater enters the process piping manure (gravity flow system), which goes into monolithic Septic tank. In sections where young animals are contained, namely in farrowing section to section in the gilts and rearing section uses a floor heating system. The project pig collected all the most modern that is today in pig production. Deep scientific approach, and the modernization of the production process ensures a high performance, which is why agriculture has some of the highest rates of productivity not only Ukrainian, but also by European standards.

CONCLUSIONS

This paper presents a case study about CSR practices of the largest pig producers of Ukraine. Finally, based on our results, we advise the pig producers work for an environmentally and socially responsible agricultural farming by:

1. *Creating healthy and safe jobs.* Create healthy and safe jobs for employees. Do this by preventing accidents, by ensuring that employees have the necessary safety equipment and by training them in managing health and safety risks.
2. *Preventing pollution of the environment.* Prevent pollution by using the environmentally best available technologies, where economically and technically feasible. Optimize the use of resources, reduce the use of pesticides, and reduce emissions of greenhouse gases and nutrients as well as store and dispose of waste and residues in an environmentally sound way. Promote also greater environmental responsibility among employees.
3. *Respecting human and labour rights.* Respect the basic human and labour rights. This means, among other things, that ensure reasonable wages, reasonable working hours, free membership of trade union and the right to collective bargaining, freedom of speech and the right to privacy and reasonable accommodation for employees who live on farms. Not engage in forced labour, and comply with the minimum standards for children's employment. Combat discrimination and promote equal rights for men and women at work. Furthermore, respect the local population's rights of land and use.
4. *Ensuring animal welfare.* Ensure animal welfare during adolescence, transport and slaughtering. This means that the animals should be housed, fed, watered and cared for in the best possible way, according to their behavioral and health needs and will be protected from pain, fear, injury or disease. Also restrict the use of preventive treatment with antibiotics and ensure a regular veterinary inspection.
5. *Ensuring good neighborliness.* Ensure good relations with farms neighbors and take an active part in the local community. Farms should be open and informative about their business and CSR efforts and listen to the local community's wants and needs to create the best possible basis for an on going dialogue.
6. *Promoting good business ethics.* Work against all kinds of corruption and bribery, including extortion and facilitation payments. Moreover, inform all farms business partners of their position on anti-corruption and conduce to fair competition.
7. *Promoting the CSR in the value chain.* Promote high CSR standards to customers, suppliers and other business partners. Work with suppliers to improve the CSR conditions, where relevant.

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PIG MARKET FROM 2000 TO 2015 AND ITS CHANGES FOR 2016 AND 2017

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Abstract. In recent years, there has been big changes in the pig and pork market. The most important were as follows: long-term downward trend of pig and pork production and the associated transformation of foreign trade from the positive balance to the negative one. The cause of population decrease was the profitability deterioration of farming. It resulted from cheaper pigs than grains and feeds as well as more expensive piglet than pig prices. The decrease of production at that time was much smaller comparing to the pig population because its level supported by the import of piglets. High pork import contributed to little increase of pork consumption. It is expected that in 2017 occur further decrease in livestock and pig production and the deepening of the negative balance of foreign trade.

Key words: hogs number, pork production, pork foreign trade, pork consumption

INTRODUCTION

Until recently, the pork market has been the most important meat market in Poland. Even in 2010, the share of pork production in production of three major types of meat amounted to 51%, while that of poultry was 38%, and of beef – 11%. As a result of a decrease in pork production and an increase in poultry production, those proportions changed. In 2015, pork accounted for 43% of production of three basic types of meat and poultry – for 46%. Beef accounted for remaining 11% (own calculations on CSO data).

This paper presents long-term tendencies in the pig market. Their changes analyses on the basis on short-term behavior the forecast of pig market presented.

DATA AND METHODS

Long-term trends occurring in the pig and pork market have been identified using economic analysis methods and static methods. The former was used also to indicate the reasons for the occurring phenomena. In turn, based on the short-term analysis

of the market its possible development in the future has been assessed. The studies made use of the published and unpublished data from the CSO, Ministry of Finance and European Commission.

At the Institute of Agricultural and Food Economics – National Research Institute, the pork market has been observed and analyzed for decades. For twenty-five years, the results of these studies have been published twice a year in a form of the analyses entitled “Meat market. Conditions and prospects”. Each month, the Agricultural Market is published where a comment is placed on a regular basis that contains a short-term assessment of this market. These studies are a basis of this article.

PIG POPULATION AND PRODUCTION IN THE YEARS 2000–2015

The long-term downward trend in the pig population has been lasting for many years, but after Poland’s accession to the European Union, the rate of the decrease in the population has accelerated [Zawadzka 2013, 2014, Szymańska 2014]. In June 2016, the pig population was 10 239 thousand heads and was by 42% lower than the average annual population in the years 2000–2004, and thus in the five-year period directly preceding Poland’s accession to the European Union and by 40% lower than the average annual population in the first five-year period after accession, and thus in the years 2005–2009. In relation to 2006, in which the population was the highest in the past dozen years, that population was lower by 46% (Table 1).

Table 1. Pig number and pig meat production

Periods	Average annual pig population (as of the population in June (thousand heads)	Indicators of changes 2000–2004 = 100	Pig meat production (thousand tons) ^a	Indicators of changes 2000–2004 = 100
2000–2004	17 705	·	2 578	·
2005–2009	16 965	95.8	2 555	99.1
2010–2014	12 561	70.9	2 277	88.3
2015	11 640	65.7	2 354	92.3
2016	10 239	57.8	2 300 ^b	89.2

^a national production means: industrial and economic slaughters increased by the export of live animals and decreased by the import of live animals

^b forecast – *Meat Market* 51/2016

Source: own calculations based on the published and unpublished CSO data.

The direct reason for the decrease in the population was the deterioration of the profitability of farming. The simplest measure of this profitability are the ratios of pig procurement prices to marketplace prices of cereals and feed. Throughout the

analysed period, those ratios became gradually restricted, which evidences that pigs become relatively cheaper than cereals and feed (Tables 2 and 3, Figs 1 and 2) [Zawadzka 2013, 2014].

Table 2. Procurement prices of pig, marketplace prices of rye and barley and ratio of procurement prices of pig to marketplace prices of rye and barley

Period	Procurement prices of pigs		Marketplace prices				Ratio of procurement prices of pigs to marketplace prices	
	PLN/kg	indicators of changes 2000–2004 = 100	of rye PLN/dt	indicators of changes 2000–2004 = 100	of barley (PLN/dt)	indicators of changes 2000–2004 = 100	of rye	of barley
2000–2004	3.84	·	41.12	·	47.75	·	9.3	8.0
2005–2009	3.93	102.3	51.43	125.1	58.37	122.2	8.2	7.1
2010–2014	4.89	127.3	68.98	167.8	80.40	168.4	7.2	6.2
2015	4.30	112.0	58.67	142.7	70.74	148.1	7.3	6.1

Source: own calculations based on the CSO data.

Table 3. Feed prices and procurement prices of pigs to prices of feed

Period	Prices of complete compound feed for fatteners II phase of fattening		Prices of feed concentrate for fatteners		Ratio of procurement prices of pigs to prices of feed	
	PLN/dt	indicators of changed 2000–2004 = 100	PLN/dt	indicators of changed 2000–2004 = 100	of compound feed	of feed concentrate
2000–2004	83.93	·	154.6	·	4.6	2.6
2005–2009	93.71	104.2	172.4	111.5	4.2	2.3
2010–2014	132.98	147.9	244.5	158.2	3.7	2.0
2015	136.22	151.5	263.1	170.2	3.2	1.6

Source: own calculations based on the unpublished CSO data.

In other words, over time, 1 kg of pigs became equivalent to the increasingly smaller quantity of cereals and feed. In 2015, 1 kg of pigs was equivalent to 7.3 kg of rye and 6.1 kg of barley, while in 2000–2004 this was, on average, 9.3 and 8 kg, i.e. more by 27 and 31%, respectively. The ratios of the prices of pigs to the prices of feed became even more restricted. In 2015, 1 kg of pig was equivalent to 3.2 kg of compound feed for fatteners (second phase of fattening), and 1.6 kg of concentrate, while in 2000–2004 this was, on average, 4.6 and 2.6 kg, respectively, and therefore more by 48 and 63%.

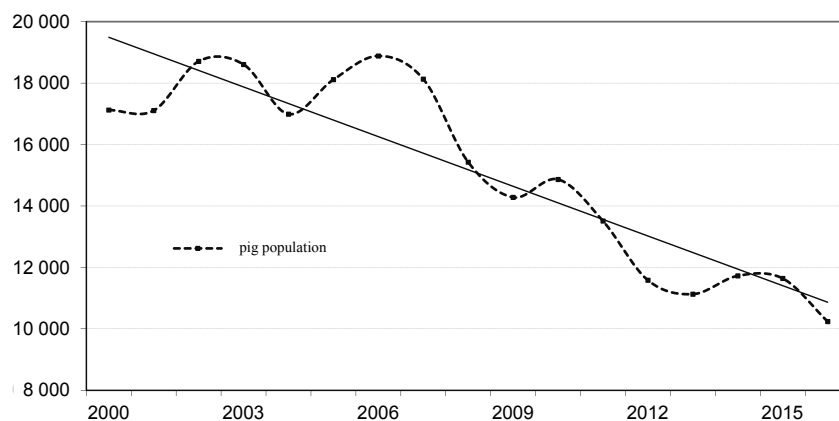


Figure 1. Pig numbers in years 2000–2016
Source: own study based on the CSO data.

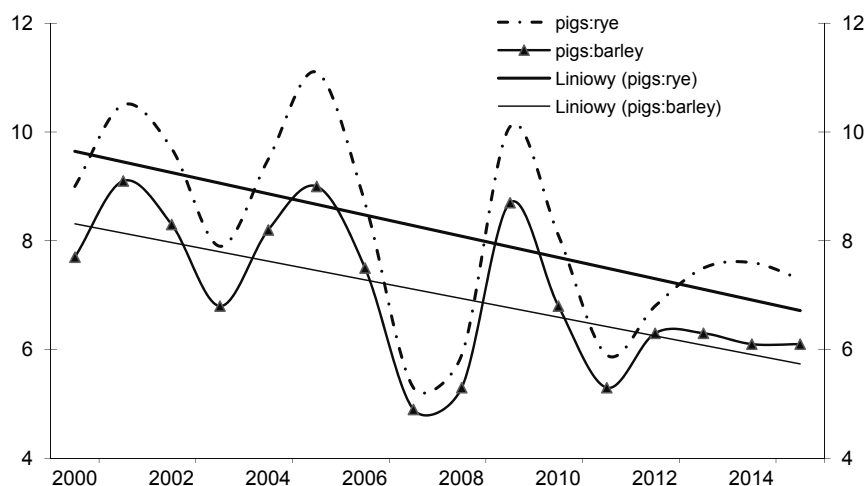


Figure 2. Ratio of pig procurement prices to marketplace prices of rye and barley
Source: own study based on the CSO data.

The situation in question resulted from the fact that in that period the prices of cereals and feed rose higher than pig prices. In relation to the average annual marketplace price of rye from the years 2000–2004 amounting to 41.12 PLN/dt, its average price in the years 2005–2009 was higher by 25%, in the years 2010–2014 by 68%, and by 43% in 2015. The rise in the marketplace price of barley in the same period was 22, 68 and 48%, respectively.

At the beginning, the prices of feed rose more slowly than the prices of cereals but in 2015, their rise was much higher [Małkowski et al. 2014, Zawadzka and Pasińska 2016]. In relation to the average price from the years 2000–2004, the average price of compound feed for fatteners (second phase of fattening) in the years 2005–2009 rose by 4%, and of feed concentrate by 12%, and in the years 2010–2014 by, respectively 48 and 58%. However, in 2015, the price of compound feed was higher than the average annual price in the years 2000–2004 by 52%, and of feed concentrate by 70%. Meanwhile, in relation to the annual average procurement price of pigs from the years 2000–2004 amounting to 3.84 PLN/kg, the average price in the years 2005–2009 was higher by 2%, in the years 2010–2014 by 27% and in 2015 by 12%.

Another, not less important parameter determining the decrease in the pig population was the fact that piglets became relatively more expensive than pigs [Zawadzka 2013, 2014]. One piglet was equivalent to an increasing quantity of live pigs. In 2015, 1 piglet was equivalent to 36 kg of pigs, while in the two previous five-year periods – to, respectively, 31 and 30 kg, and in the years 2000–2004 – 25 kg, on average (Fig. 3). Both pigs becoming relatively cheaper than cereals and feed and piglets becoming relatively more expensive than pigs point to the rise in the production costs of fatteners and are basic reasons for the long-term downward trend in the pig population.

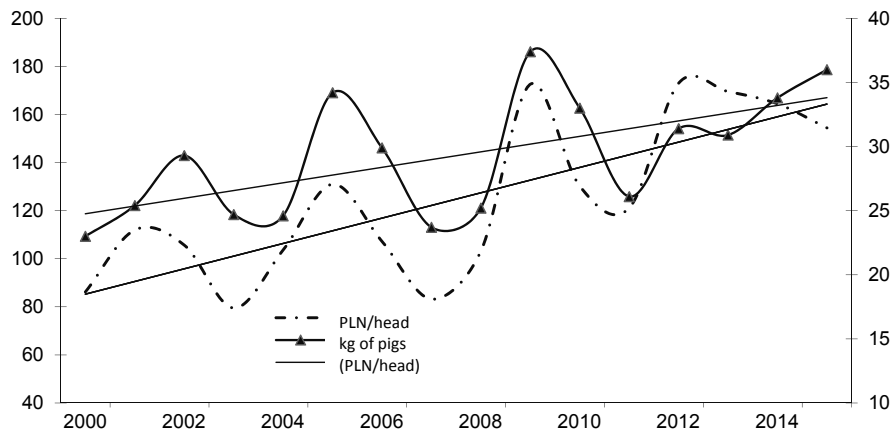


Figure 3. The absolute and the relative prices of piglets
Source: own study based on the CSO data.

It may be assumed that the fact that piglets became more expensive in relation to pigs could be contributed to, i.a. by their declining domestic production (reduction in the population of sows), as well as the growing demand for imported pigs, as

evidenced by the dynamically growing import of piglets and weaners. The import of piglets and weaners appeared in 2004 and has since been steadily growing. In 2015, it amounted in total to 5.1 million heads, including 4.6 million piglets. This import was by 2.5 times higher than in 2010. The import is implemented mostly by meat establishments, which as part of so-called contract fattening, provide farmers with purchased piglets and receive fatteners of guaranteed quality, but importers of piglets are also breeders expecting higher prices for live animals they sell.

The import of piglets on such a large scale points to shortcomings in genetic progress (number of piglets in a litter, efficiency of grazing etc.) of animals bred in Poland, or in the dissemination of this progress. Polish piglets, when compared to Danish or Dutch piglets, are basically competitive in terms of their price, although their competitiveness is slowly decreasing, especially with respect to the Netherlands (Table 4). However, given the fact that Polish piglets weigh, on average, 25 kg, while Danish piglets, for example, about 30 kg, the prices of Polish piglets per 1 kg may be higher than those of Danish piglets even by a dozen or so percent. Nevertheless, it seems, therefore, that apart from the price competitiveness an important role is played by the qualitative competitiveness, whose importance is constantly growing.

Table 4. Piglets prices in Poland, Denmark, the Netherlands and Germany

Year	EUR/head					Prices in Poland in % of prices in	
	Poland	Denmark	the Netherlands	Germany	Denmark	the Netherlands	Germany
2011	28.34	40.62	29.58	45.33	69.8	95.80	62.5
2012	42.67	45.29	38.78	56.35	94.2	110.3	75.7
2013	41.20	45.29	38.78	56.50	91.0	106.2	72.9
2014	39.62	43.17	31.74	51.79	91.8	124.8	76.5
2015	36.15	38.81	21.99	41.79	93.1	164.4	86.5

Source: own calculations based on the European Commission data.

In a situation where the ratios of pigs to cereals and pigs to feed prices become restricted, genetic progress becomes one of the more important factors determining the reduction in production costs, and thus the improvement in the profitability of farming. The lack of high quality piglets will make us import more and more of them. Undoubtedly, the large fragmentation of holdings is not a factor which fosters the introduction of new production technologies and genetic progress. However, a cure for this fragmentation could be producer groups, which, at least in part, could alleviate this unfavorable situation.

The scale of the decrease in production is smaller than the scale of the decrease in the pig population, as pig production depends not only on the pig population, but also on its productivity. In the last 10 years, we are dealing with a constant increase in

this productivity which increasingly affected pig production. In the years 2004–2006, average annual slaughter of pigs exceeded the population by 31%, and in the years 2010–2014 by 401. As a result, pig production per 1 head in the population, which in the years 2000–2004 was, on average, 110 kg, in the years 2005–2009 113 kg, in the years 2010–2014 129 kg, and in 2015, 150 kg [Zawadzka and Pasińska 2016]. Usually, this results from genetic or technological progress but this large increase could, as we may assume, result mainly from the increased import of piglets.

In 2015, pig production was 2 354 thousand tons and was by 7.7% lower than average production in the years 2000–2004, and in the years 2010–2014 characterized by the decrease in the population by about 30% when compared to the baseline period (2000–2004) by 12%. Its relatively small decrease allowed to maintain the consumption of pork at a similar level, and even a small increase. In the years 2010–2014, the consumption of pork amounted to 39.7 kg per capita and was by 0.3 kg per capita higher than in the years 2000–2004 [Zawadzka 2015]. In 2015, it increased to 41.5 kg per capita, due to the increase in production, which in that year was by 2% higher than in the previous year (2014).

FOREIGN TRADE IN PIGS AND PORK

Over the past ten years, Poland has turned from the net exporter of pork into its importer. In addition, the negative balance deepens [Stańko 2012]. In the years 2010–2014, it amounted to 157 thousand tons, when compared to 32 thousand tons in the years 2005–2009 and the positive balance in the years 2000–2004 amounting to 86 thousand tons. In 2015, it further deepened to 184 thousand tons. This situation resulted from the higher increase in the import than in the export in this period. In the years 2010–2014, the average annual export of 572 thousand tons was almost by four times higher than in the years 2004–2006. On the other hand, the import reached in that period the average annual level of 729 thousand tons and was by 10 times higher than in the years 2004–2006.

Table 5. Foreign trade of pork, in a thousand tons of postmortem weight (including fats)

Period	Export	Import	Balance
2000–2004	154	68	86
2005–2009	321	353	–32
2010–2014	572	729	–157
2015 ^a	645	829	–184

^a inconclusive data

Source: own calculations based on the unpublished MF data.

In 2015, the export increased by 13% in comparison with the previous period, and the import by 14%. Therefore, we had to deal with the continuing discrepancy of their development. The reasons for this are quite complex. The basic ones include the decrease in pig production in Poland, which was accompanied by the relatively stable consumption of pork, as well as the fact that the Polish prices of pork became similar to the average EU prices. Despite this, we may think that such the large increase in the import, apart from the prices, was also determined by the quality of imported raw material. In 2015, 74% of the import was pork (according to the weight of the product), further 23% – live pigs, and the remaining 3% processed pork. The negative balance, which in the weight of the product was 242.9 thousand tons, was dominated by the negative balance in trade in meat amounting to 269.3 thousand tons. The positive balance occurred in case of pork products and fats.

ENVISAGED DEVELOPMENT OF THE PIG POPULATION AND PIG PRODUCTION IN 2017

In the development of the pig population, in addition to long-term trends, we also distinguish short-term changes [Zawadzka 2014]. The basis for changes in the pig population and pork production in recent years has been the improved profitability of farming that followed the harvest in 2013, as a consequence of the decreased prices of cereals and relatively high prices of pigs. In the second half of 2013, the ratios of the prices of pigs to the prices of cereals were significantly wider than in the previous year (ratio of the prices of pigs to rye improved by 17%, and ratio of the prices of pigs to barley by 6%). Admittedly, in the first half of 2014 those ratios became restricted due to the decrease in the prices of pigs (by 6% per year), caused by the Russian embargo on the import of pork from the European Union, but they still were wider than in the previous year (ratio of the prices of pigs to rye by 17%, and ratio of the prices of pigs to barley by 6%). Owing to them, in March 2014, the pig population increased by 2.3% per year, in June by 5%, and in December by 2.3% again. As a result of positive changes in the pig population, pork production also increased, which in the first half of 2014 was higher than in the previous year by 9.5% and in the second half by 14.9%.

The increasing growth in pork production, which appeared not only in Poland, but also in many European Union countries led, however, to the even deeper decrease in its prices and the deterioration of profitability again. Admittedly, the situation was partially saved by further reductions in the prices of cereals and feed after the harvest in 2014, but they were lower than the prices of pigs, therefore, month by month, the economic conditions of farming were worse and worse. In December 2014, as a result

of the decrease in the prices of pigs by 21% per year, the ratio of the prices pigs to rye was 1 : 7.3, and pigs to barley 1 : 5.8. They were more restricted than in the previous years by, respectively 6 and 8%. In January 2015, those ratios became restricted to 1 : 6.8 (pigs : rye) and 1 : 5.6 (pigs : barley). Even back then, they pointed to the unprofitability of farming. This was expressed by the lower than in the previous year (3.1%) population of pregnant sows at the end of March 2015. Admittedly, back then the total pig population was still higher by 2.9%, but the collapse, whose first signal is always the reduction in the population of sows was started. In June 2015, the pig population decreased by 0.7% and in December by 6%.

Therefore, there was a breakthrough in the development of pig production, which in the first half of the year amounted to 1 184 thousand tons and was higher than in the previous year by 5.9%, but when the decrease in the pig population made its presence felt, production collapsed, giving rise to the next downward phase. In the second half of 2015, pig production amounted to 1 170 thousand tons and was by 1.9% lower than in the previous year. As a result, throughout 2015, it was 2 354 thousand tons and was by 1.9% higher than in 2014.

The reduction in Polish pork production in the second half of 2015 did not increase its prices as in the EU market production continued to increase, and therefore the prices of pork were low. The average procurement price of pigs, which in the first half of 2015 was 4.32 PLN/kg decreased in the second half to 4.25 PLN/kg. In relation to the same periods of the previous year, those prices were lower by 13 and 11%, respectively. The average annual price was 4.30 PLN/kg and was by 10.9% lower than in 2014 and by 21.7% lower than in 2013.

The end of the downward trend in the prices of pigs, which lasted for more than two years, took place in mid-2016, when the upward trend was started in the European Union. In June, when the average EU-28 price of E-class pigs amounting to 151.38 EUR/100 kg of post-mortem weight was higher by 3% than in the previous year. In July, the annual growth rate was significantly higher and amounted to 12% and in August 14%. In those months, the average in EU-28 prices of E-class pigs were 161.56 and 163.5 EUR/100 kg, respectively. In Poland, the prices of E-class pigs expressed in EUR rose to the greater extent than the average EU prices due to the larger decrease in production in that period. In June, the price of pigs was higher than in the previous year by 4%, in July by 15%, and in August by 18%, and the prices in the following months amounted to 150.30, 161.22 and 163.50 EUR/100 kg of post-mortem weight.

The rise in the prices expressed in PLN took place a little earlier and was even higher than that of the Polish prices expressed in EUR. This was due to the depreciation of PLN against EUR. As early as in May, the average procurement price amount-

ing to 4.50 PLN/kg of live weight was by 6% higher than in the previous year. In June, the procurement price amounted to 4.90 PLN/kg and was by 9% higher than in May and by 20% higher than in May 2015. In July and August, the annual growth rate increased to 21%, and the prices were 5.30 and 5.31 PLN/kg, respectively.

At the beginning, the rise in the price of pigs did not significantly extend the ratios of profitability, but improved them. In May, the ratio of the prices of pigs to the marketplace prices of rye was 1 : 7.6 when compared to 1 : 7.4 in the previous year, and the ratio of the prices of pigs to the prices of barley was 1 : 6.4 when compared to 1 : 6.0. In June, those ratios extended by, 5 and 9%, respectively. The ratio of the prices of pigs to rye was 1 : 8.2 and the ratio of the prices of pigs to barley was 1 : 7.0. In July, the ratio of the prices of pigs to rye was 1 : 8.8 when compared to 1 : 7.7 in the previous year and the ratio of the prices of pigs to barley was 1 : 7.0 when compared to 1 : 6.4. In August, the ratio of the prices of pigs to the prices of rye, however, extended to 1 : 9.3, and the ratios of the prices of pigs to barley to 1 : 8.0. These ratios are so high that they offer a chance to mitigate the rate of decrease in the pig population at the end of the year. Therefore, it is assessed that at the end of the year the pig population may be about 10 million heads and be by about 5% smaller than in the previous year.

However, a number of other factors will also determine if it happens. Usually, the first signal attesting to the growing interest in farming pigs is the rise in the prices of piglets. In July and August, it was almost invisible, as during the year, the prices of piglets rose by, 0.4 and 0.3%, respectively. This may be determined by detecting further African swine fever (ASF) outbreaks and related concerns of farmers. The incoming months will show how strong these concerns are.

In connection with the expected further rise in the prices of pigs (not disturbed by the spread of the ASF disease) in the first half of the year 2017, it is also assessed that in June 2017, the pig population may also be about 10 million. Then, it would be lower than in June 2016 by 2–3%. If after the harvest 2017, the prices of cereals do not rise significantly, at the end of the year 2017, a slight (about 2%) increase in the pig population could take place.

In connection with the above, it is assessed that in 2016 pig production may be about 2 300 thousand tons and be by 2% lower than in 2015. In 2017, its decrease may grow to about 3% and production may be 2 230 thousand tons.

The decrease in production may result in the small decrease in the export and also in the small increase in the import. The level of foreign trade will be determined by the demand in the domestic market and in foreign markets [Zawadzka and Pasińska 2016]. However, due to the rise in the retail prices, the domestic demand will probably become weaker, and the consumption both in 2016 and 2017 will be

lower than in 2015. In July 2016, the retail price of pork was by 3.8% higher than in the previous year and by 5% higher than in December 2015. In August, its increase was even higher and amounted to 5.1% per year and 6.8% in relation to December 2015 [Świetlik 2015].

SUMMARY

In the development of the pig population and pork production, we may identify long-term trends and short-term fluctuations. In this article, we identified the long-term downward trend in the pig population and pork production. It was assessed that in 2016 in relation to the years 2000–2004, and thus right before Poland's accession to the European Union, the pig population decreased by 42%. The reason for this phenomenon is the fact that pigs become relatively cheaper than cereals and feed and piglets became relatively more expensive than pigs.

The decrease in pork production was smaller in that period due to the growing import of piglets supporting the growth of the efficiency. In 2016, pig production was by 11% lower than the average annual production in the years 2000–2004. The decrease in the pig population and production determined foreign trade in pigs and pork. The lower growth in the export than in the import resulted in turning the balance of this trade from positive into negative, and in addition this negative balance is becoming deeper and deeper.

On a basis of an analysis made in the short term, it is assessed that in December 2016 and in June 2017, the pig population may be about 10 million head. In relation to the same periods in the last year it would be lower by 5 and 2–3%, respectively. The reduced rate of the decrease may be due to the progressive improvement in the profitability of farming resulting mainly from the rise in the prices of pigs. At the same time, it is assessed that in 2016, pig production may be lower by about 2%, and in 2017 by about 3%. These changes will affect the changes in foreign trade and the consumption of pork.

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