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## FIFTEEN YEARS OF POLISH AGRICULTURE IN THE EUROPEAN UNION

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### Abstract

*The aim of the study was to characterize: a) financial aid paid to farmers under the Common Agricultural Policy and sources of funds from 2004-2018; b) changes in agriculture in terms of: factors of production, cultivation area and production of the main crops in total and per capita, livestock farming and production of the main animal products in total and per capita, productivity (land, labor, and fixed assets), marketability and profitability (land, labor, and fixed assets), self-sufficiency in the production and consumption of: cereals, potatoes, cow's milk, hen eggs, as well as meat and offal. The period of 2001-2003 was adopted as the base period for comparisons, i.e., three years before Poland's accession to the European Union, while the last period was 2016-2018, due to the availability of verified statistical information; c) position of Polish agriculture in the EU from 2004-2005 (EU-25), as well as 2010 and 2019 (EU-28).*

*The analysis showed positive changes in all the discussed issues, except for land management, whose exclusion from agricultural production requires urgent state interference to reduce the pace of this process. The position of Polish agriculture in the EU generally ranks proportionally to land resources or higher. However, it is weaker in the case of animal production compared with crop production. Trade turnover in agri-food products and a positive trade balance are systematically growing.*

**Keywords:** common agricultural policy, subsidies, productivity, self-sufficiency, position.

**JEL codes:** Q17, Q18, N54.

## Introduction

The marketization of the economy, and subsequently Poland's accession to the European Union, caused changes in all areas of Poles' lives, including rural areas and agriculture. On May 1, 2019, fifteen years passed since Poland had joined the EU and agriculture had been subject to the rules of the Common Agricultural Policy (CAP). Functioning of Polish agriculture under the CAP is the subject of numerous studies on selected issues. The regular publication entitled *Rural Poland. The Report on the State of Rural Areas* (Polish title: *Polska wieś. Raport o stanie wsi*) deserves special attention. It is edited by J. Wilkin and analyzes various issues of rural areas and agriculture. However, there is no study that would describe the transformation of agriculture as a whole. The present study is an attempt to fill this gap. The described structural and production changes occurred during the accession period as a result of a combination of various factors, with accession being one of them.

The aim of the research was to characterize:

- a) financial aid paid to farmers under the common agricultural policy and sources of funds from 2004-2018;
- b) changes in agriculture in terms of: factors of production, area of crops and production of the main crops in total and per capita, livestock farming and production of the main animal products in total and per capita, productivity (land, labor, and fixed assets), marketability (land, labor, and the share of market output in global production), profitability (land, labor, and fixed assets), self-sufficiency in the production and consumption of: cereals, potatoes, cow's milk, hen eggs, as well as meat and offal. The period of 2001-2003 was adopted as the base period for comparisons, i.e., three years before Poland's accession to the European Union, while the last period was 2016-2018, due to the availability of verified statistical information. Owing to natural and economic factors, in agriculture there are fluctuations in the cultivation of individual crops, animal farming and the productivity of crops and animals. There are also fluctuations in the prices of means of production and production itself. The adoption of three-year periods enables eliminating annual fluctuations and obtaining more comparable results of the activity;
- c) position of the Polish agriculture in the EU from 2004-2005 (EU-25) and 2010-2019 (EU-28).

## Materials and methods

The study was based on sources of knowledge such as non-serial and regular scientific publications as well as statistical materials from Statistics Poland and its local agendas.

The collected material was developed and interpreted using the following methods: a comparative analysis in a vertical form (Kapusta, 1976; Stachak, 2003), a statistical (Stachak, 1997) assessment of food self-sufficiency (Kapusta, 2012), distinguishing technical and economic self-sufficiency. Technical self-sufficiency is determined by four indicators:

- a) calculation of the difference between exports and imports (in natural units);
- b)  $S_s$  index, which is the quotient of domestic production ( $Dp$ ) and domestic consumption ( $Dc$ ) (in this case: consumption, reproduction, industrial consumption, grazing, and losses and damages) according to the formula:

$$S_s = \frac{Dp}{Dc} \times 100;$$

where:

$S_s$  – degree of self-sufficiency,

$Dp$  – domestic production,

$Dc$  – domestic consumption;

- c) share of consumption in production (%),
- d) share of imports in consumption (%),
- e) share of exports in domestic production (%).

The economic self-sufficiency was established by calculating the balance of trade turnover in terms of value (PLN, EUR). In the analysis of the occurring phenomena, the indicators of the structure and dynamics of changes were used. The research results were presented in the tabular technique and described.

### **Financial support of national funds with the European Union funds**

From the beginning of the systemic changes, Poland has suffered from a shortage of financial resources for the needs of economic reconstruction. The adoption of the document entitled “Coherent structural policy of rural development and agriculture” in 1999 (Ministry of Agriculture and Food Economy, 1999) established the basis for building a legal and institutional infrastructure for accepting the European Union aid for structural changes in rural areas, mainly from the SAPARD program<sup>1</sup>. SAPARD funds were aimed at four measures included in its program: 1) improving processing and marketing of agricultural and fishery products; 2) investments on farms; 3) development and improvement of rural infrastructure; 4) diversification of economic activity in rural areas. Both rural areas and agriculture benefited from other aid programs, such as Phare and ISPA.

The inflow of more funds for the development of agriculture and processing and the opening of the EU market to Polish products already in 2001 resulted in an increase in exports of agricultural products and the food industry, which resulted in a positive balance of trade in the goods for the first time in 2003, the balance continues to increase (Kapusta, 2017).

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<sup>1</sup> SAPARD (Special Accession Programme for Agriculture and Rural Development) is an EU financial program for countries awaiting membership in the European Union to support adapting agriculture to the market economy in associated countries. The program was terminated in 2006. In total, 24,431 applications for PLN 4,779 million were registered. The EU funds covered about 50% of the project costs, the rest of the costs and VAT were covered by beneficiaries.

Since the beginning of accession to the European Union, in addition to the Common Agricultural Policy (CAP), Poland has also benefited from the cohesion policy. Its implementation has a strong territorial dimension, and the programs serve to improve the quality of life in rural areas (road construction, public transport, sewage treatment plants, health centers, construction of educational institutions, cultural institutions, development of human capital, etc.). The funds indirectly contribute to the development of agriculture and non-agricultural entities, contributing to the deepening of the multi-functionality of rural areas (Kapusta, 2014a, pp. 14-15).

After Poland joined the EU, the expenditure of the national budget on agriculture was supported by the EU funds as part of direct payments, and from 2004-2018, PLN 177,176.3 million was allocated to agriculture (Table 1). This payment is universal and therefore there is a visible increase in the farm income.

Table 1

*Direct payments made and average payment per farm from 2004-2018*

| Year | Number of farmers who were granted a payment in millions | Amount of payments made in PLN million <sup>a</sup> | Average payment per farm PLN | Year | Number of farmers who were granted a payment in millions | Amount of payments made in PLN million <sup>a</sup> | Average payment per farm PLN |
|------|--|---|------------------------------|------|--|---|------------------------------|
| 2004 | 1,337.8  | 6,342.7   | 4,570                        | 2012 | 1,357.0  | 13,734.5  | 10,121                       |
| 2005 | 1,468.9  | 6,692.2   | 4,556                        | 2013 | 1,354.4  | 14,133.1  | 10,435                       |
| 2006 | 1,455.7  | 8,202.4   | 5,634                        | 2014 | 1,351.8  | 14,186.2  | 10,494                       |
| 2007 | 1,444.2  | 8,281.1   | 5,734                        | 2015 | 1,351.1  | 14,315.8  | 10,596                       |
| 2008 | 1,418.2  | 8,588.7   | 6,083                        | 2016 | 1,348.8  | 14,629.9  | 10,847                       |
| 2009 | 1,386.8  | 12,150.6  | 8,761                        | 2017 | 1,339.3  | 14,605.0  | 10,905                       |
| 2010 | 1,372.1  | 12,582.4  | 9,170                        | 2018 | 1,335.2  | 14,592.2  | 10,929                       |
| 2011 | 1,356.7  | 14,139.5  | 10,422                       |      |  |   |                              |

<sup>a</sup> including: single area payment (SAPS), complementary direct payment, energy surcharges, sugar payments, separate fruit and vegetable payment, transitional soft fruit payment, special support.

Source: Sass and Tabaczyński, 2020, p. 28.

The amount of direct payments made increased from PLN 6,342.7 million in 2004 to PLN 14,592.2 million in 2018, i.e., by 130.1%. The average payment per farm increased from PLN 4,570 in 2004 to PLN 10,929 in 2018, i.e., by 139.1%, which was due to an increase in the amount of subsidies and a decrease in the number of beneficiaries. Obviously, the amount of this support varied on farms depending on the type of farming and economic size (Sass and Tabaczyński, 2020, p. 28).

As a result of negotiations with the European Commission (EC), Poland obtained the right of co-financing in a specific amount of direct payments in individual years, reaching 100% of direct payments from the EU budget only in 2013.

In this situation, state budget expenditure on agriculture had to be increased and amounted to (%): in 2004 — 2.89, 2005 — 3.29, 2006 — 3.74, 2007 — 6.67, 2008 — 8.58, 2009 — 6.18, 2010 — 9.83, 2011 — 9.1, 2012 — 8.34, 2013 — 8.39. It should be noted that before the accession, between 1997 and 2003, the share of expenditure on agriculture amounted to an average of 2.23% (Nurzyńska, 2012, pp. 175-183). Thus, the share of agricultural expenditure in the state budget increased 2.8 times already in 2013 (Kapusta, 2017).

The number of direct payment beneficiaries has changed; in 2004, there were 1,337.8 million of them, and in 2005 their number accounted for 1,468.9 million (the greatest number), and then it systematically decreased and in 2018 it amounted to 1,335.2 million. Each year, the percentage of granted payments to submitted applications was over 99%.

The role of direct payments as an income-generating factor in agriculture is increasing year by year. If subsidies accounted for less than 9% of farmers' income before the accession, then from 2009-2010 their share was higher than 60% (Poczta, 2012, p. 93). As a result of membership in the EU, our agriculture largely depends on the common agricultural policy, the main goal of which is:

- increasing farmers' income thanks to the annual granting of direct payments and, additionally, the use of market intervention instruments;
- financing tasks related to environmental protection, climate change, restructuring agriculture and implementation of innovations, including the production process.

## **Structural changes in agriculture**

### ***1. Changes in production factors***

Agricultural production is created as a result of the joint application of the three factors of production, i.e., land, labor, and capital. Usually they enhance their productivity, so that we can talk (obviously to some extent) of complementarity. In some cases, production factors may replace each other (substitution) and may compete instead of complementing each other (Sondel, 1964; Fereniec, 1999; Kapusta, 2007). Changes in the resources of production factors are summarized in Table 2.

The foreground in the assessment of changes is land management as the basic production factor in agriculture and forestry, without which the activities cannot be carried out. All properties of the land as a means of labor, determining its passive (location, shape of the land, topography, geological structure) and active function (soil fertility, culture, microclimate properties), determine its quality, value, preciousness, and usefulness. (Kapusta, 2012, pp. 111-112). The structure of land use affects: the direction of agricultural production, the amount of labor demand, capital resources (fixed and current).

Table 2

*Changes in the resources of production factors from 2001-2003 and 2016-2019*

| Description                                       | Average   |           | Changes  |          |
|---|-----------|-----------|----------|----------|
|   | 2001-2003 | 2016-2018 | quantity | %        |
| Agricultural land area (UAA) (thousand ha)        | 16,952.2  | 14,610.9  | -2,341.3 | -13.8    |
| UAA per capita (a)                                | 44.36     | 38.02     | -6.34    | -14.3    |
| Number of farms (thousand)                        | 1,899.2   | 1,415.1   | -484.1   | -25.5    |
| Average farm area (ha)                            | 8.93      | 10.32     | 1.39     | 15.6     |
| Employed persons in agriculture (AWU thousand1)   | 2,103.5   | 1,674.0a  | -429.5   | -20.4    |
| Employed persons per 100 ha of UAA (AWU)          | 12.4      | 8.7       | -3.7     | -29.8    |
| Value of fixed assets PLN / ha of UAA, including: | 6,508.35  | 9,976.15  | 3,467.80 | 53.3     |
| – buildings and structures (%)                    | 61.7      | 61.4      | -0.3     | -0.3 pp. |
| – machines, technical devices, and tools (%)      | 12.9      | 18.6      | 5.7      | 5.7 pp.  |
| – means of transport (%)                          | 11.7      | 8.9       | -2.8     | -2.8 pp. |
| Tractors in agriculture (thousand pcs)            | 1,348.1   | 1,491.7b  | 143.6    | 10.7     |
| Per 1 tractor ha of UAA                           | 12.57     | 9.79      | -2.78    | -22.1    |
| Consumption of NPK (kg/ha of UAA)                 | 92.4      | 137.4     | 45.0     | 48.7     |
| Consumption of CaO (kg/ha of UAA)                 | 94.3      | 58.8      | -35.5    | -37.6    |

<sup>1</sup> Annual Work Unit = 265 days × 8 hours = 2,120 man-hours; <sup>a</sup> estimate, <sup>b</sup> 2016

Source: Statistics Poland, 2005; 2017-2020; author's own calculations.

In the analyzed periods (2001-2003 and 2014-2018), agricultural land area decreased as a result of withdrawing from agricultural use for other purposes by 2,341.3 thousand ha, i.e., by 13.8%. This resulted in a decrease in the area of agricultural land per capita (the so-called food area) from 44.36 to 38.02 ares, i.e., by 14.3% (Kapusta, 2017).

Reducing arable land per capita with the constant striving to increase the level of meeting the food needs of the society (quantitative and qualitative) requires using factors substituting land in the production process – most often an increased consumption of chemical means of production. Such actions pose a threat to the natural environment and deteriorate the quality of produced agricultural raw materials.

Land is managed on farms, creating their number and area structure. In the analyzed period, the number of farms decreased by 484.1 thousand, i.e., by 25.5%, and the average area of a farm increased from 8.93 to 10.32 ha, i.e., by 15.6%. If there was no reduction in the agricultural area, the average farm area would increase by a further 34 ares. The changes should be assessed as satisfactory, especially since the number of the smallest farms (up to 20 ha) decreases in the first position, and the number of larger farms (over 20 ha) increases (Kapusta, 2013c, pp. 86-88).



Labor resources are the second factor of production. The course of the economic process and its result depend on the quantity and quality of labor resources. The labor factor means executive and managerial work, although the latter is more and more often using the term management, which is related to making decisions. Decision-making includes functions of entrepreneurship, such as risk taking and organization of production; the terms “entrepreneurship” and “enterprise management” are used to describe these functions (Heijman, Krzyżanowska, Gądek and Kowalski, 1997, p. 363). On individual farms, most often the same person performs management activities and executive work.

Labor force resources (labor factor) express the amounts of labor force applied and possible to be used in production. Units of the resources are natural persons. Labor force includes the working-age population and the economically active population at non-working age (pre- and post-production) (Kapusta, 2014c).

Today, labor resources in agriculture are expressed in annual work units (AWU)<sup>2</sup>. In the discussed period, labor resources decreased by 429.5 thousand AWU, i.e., by 20.4%. The resources are assessed on the basis of the declarations of persons employed in agriculture as to working time. They were heterogeneous: until 2014 they increased and then decreased. Part of the resources, reduced in agricultural production, was developed on farms by undertaking non-agricultural activities. Particular attention should be paid to an increase in the share of young people and women, both among the employed and farm managers, and an increase in the level of education (Kapusta, 2014c, p. 95). Polish farmers are the youngest in the EU, the pace of their aging is the weakest, but they are also among the worst educated both in terms of level and direction (Knieć, 2021).

The third factor of production, capital, means today in agriculture on the one hand real (physical) capital, on the other rights to real capital. Real capital (capital goods, investment goods) is the result of the production process, representing expenditures on the production of future goods and services. Understood in such way, it may take material form (land, perennial plantings, livestock, buildings and structures, machinery and equipment, inventories of production factors) and immaterial form (patents, licenses, trademark, reputation). In material form, there are fixed assets – fixed capital and current assets – variable capital.

There are many ways to classify fixed assets in agriculture according to different principles. Among fixed assets, different groups can be distinguished, depending on the production purpose, the nature of their reproduction, sources of their production, and their direct relationship with the production process of agricultural products (Gierusz, 2007; Kapusta, 2012). Detailed classification by type of fixed

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<sup>2</sup> A system of harmonized agricultural labor input (ALI) statistics was established in Europe. It is used, inter alia, to express farmers' labor inputs in a new unit – Annual Work Unit (AWU) corresponding to a minimum of 1,800 hours per year = 225 days × 8 hours = 1,800 man-hours (Target methodology for agricultural input (ALI) statistics (Rev. 1), Luxembourg 2000). Some EU countries have adopted a minimum standard, while others apply their own standards for the working time of farmers, e.g., Luxembourg and Greece adopted 275 days a year, Poland 265 (i.e., 265 days × 8 hours = 2,120 man-hours), Lithuania 254, Austria 250, Portugal 240, Spain and France 228.



asset objects is developed and updated by Statistics Poland which also provides information on their condition in macroeconomic terms. Here, we will discuss changes in fixed assets of non-agricultural origin in terms of Statistics Poland and current assets: NPK and CaO mineral fertilizers (Kapusta, 2017).

In the discussed period, the value of fixed assets in agriculture increased by PLN 3,467.80 million, i.e., by 53.3%. It should be emphasized that there was a decrease in the percentage share of buildings and structures (passive capital) and means of transport, while an increase in the share (active capital) of machines, technical devices, and tools by 5.7 percentage points. The number of tractors increased by 143.6 thousand units, i.e., by 10.7%, and the area of agricultural land per 1 tractor decreased by 2.78 ha, i.e., by 22.1%. It should be added that the new tractors are more powerful and are equipped with devices supporting farmers' work. Along with the increased number of tractors, there is also an increase in accompanying machines. On the one hand, such changes create a better saturation of agriculture with agricultural technology, improve working conditions, and on the other hand generate higher production costs. Fixed assets constitute the basis for the organization of economic activity and serve increasing competitiveness of economic entities. After Poland joined the European Union, Polish agriculture gained an additional source of funds for modernization, i.e., from programs such as SAPARD, Sectoral Operational Program, Rural Development Progra – apart from farms' own resources, loans, and funds from the state budget (Kapusta, 2017).

Decreased land resources in agriculture are accompanied by an increase in the use of chemical means of production. It is most visible in the case of mineral fertilizers, the consumption of which is expressed in the pure component of NPK/ha of UAA. In the discussed period, this increase amounted to 45.0 kg/ha, i.e., 48.7%. It is alarming that the consumption of calcium fertilizers –(CaO) was reduced by 35.5 kg/ha, i.e., by 37.6%. The use of low fertilization with calcium fertilizers causes soil acidification, which contributes to the reduction of the effectiveness of using NPK fertilizers and worsens the quality of crop products. This shows the low level of knowledge of farmers in the field of crop fertilization and no agents supporting the correct fertilization with calcium fertilizers (e.g., by shaping prices for calcium fertilizers, the use of subsidies for this treatment, or better work of advisory services).

## **2. Changes in the organization of crop production and crop productivity**

Changes in the resources of production factors most often entail changes in the organization of production; reduced land resources cause shifts in the cultivation of the individual crops (competition for land). There may also be competition for other factors of production. The changes occur due to the influence of prices on production factors and prices on agricultural products. Demand for certain products causes their prices to increase, which may translate into higher profitability of production and shifts in the distribution of the consumption of production factors. In the analyzed period, cultivation area decreased by 601.0 thousand ha, i.e., by 5.3%, including cereals by 823.0 thousand ha, i.e., by 9.8%, potatoes by 616.7 thousand ha, i.e.,

by 67.0%, while there was an increase in the cultivation of industrial crops (mainly rape) by 364.7 thousand ha, i.e., by 46.8% (Table 3). There were also changes in the cultivation of other crops (Kapusta, 2017).

Table 3

*Cultivation area and production of the main plant products*

| Description   | Average   |           | Changes      |       |
|---|-----------|-----------|--------------|-------|
|   | 2001-2003 | 2016-2018 | quantitative | %     |
| I. Cultivated area (thousand ha), including:                    | 11,343    | 10,742    | -601.0       | -5.3  |
| – cereals   | 8,425.7   | 7,602.7   | -823.0       | -9.8  |
| – potatoes  | 921.0     | 304.3     | -616.7       | -67.0 |
| – industrial crops  | 780.0     | 1,144.7   | 364.7        | 46.8  |
| II. Production of main crop products<br>(thousand tonnes or kg) |           |           |              |       |
| cereals (thousand tonnes)                                       | 25,742.8  | 29,518.0  | 3,775.2      | 14.7  |
| – cereals per capita (kg)                                       | 673.6     | 776.0     | 102.4        | 15.2  |
| – potatoes (thousand tonnes)                                    | 16,211.4  | 8,297.3   | -7,914.1     | -48.8 |
| – potatoes per capita (kg)                                      | 424.2     | 215.9     | -208.3       | -66.1 |
| – sugar beet (thousand tonnes)                                  | 12,179.1  | 14,520.0  | 2,340.9      | 19.2  |
| – sugar beet per capita (kg)                                    | 318.7     | 377.9     | 59.2         | 18.6  |
| – oilseeds (thousand tonnes)                                    | 958.6     | 2,439.7   | 1,481.1      | 154.5 |
| – oilseeds per capita (kg)                                      | 25.1      | 63.5      | 38.4         | 153.0 |
| – ground vegetables (thousand tonnes)                           | 5,122.7   | 4,413.0   | -709.7       | -13.9 |
| – ground vegetables per capita (kg)                             | 134.0     | 114.8     | -19.2        | -14.3 |
| – crops under cover (thousand tonnes)                           | 601.8     | 1,115.7   | 513.9        | 80.8  |
| – vegetables under cover per capita (kg)                        | 15.7      | 29.0      | 13.3         | 84.7  |
| – fruit from trees and berries (thousand tonnes)                | 3,246.7   | 4,289.3   | 1,042.6      | 32.1  |
| – fruit from trees and berries per capita (kg)                  | 84.9      | 111.6     | 26.7         | 31.4  |

Source: Statistics Poland, 2005, 2017, 2019; author's own calculations.

The question arises as to how the changes in the cultivation area influenced the global production of the individual products and per capita. As production is carried out to meet human needs, it is therefore appropriate to calculate the production per capita. In the analyzed period, the production of cereals increased by 3,775.2 thousand tonnes, i.e., by 14.7%, and the production increase per capita is 15.2%. It was possible because of shifts in the cultivation of particular types of cereals; reduction of crops with lower yields and an increase of crops with higher yields, as well as an increase in the yields of all crops (e.g., due to biological progress).

The production of potatoes decreased significantly by 7,914.1 thousand tonnes, i.e., by 48.8%, and per capita by 208.3 kg, i.e., by 66.1%. This was due to the almost complete abandonment of their use in feeding animals (fattening pigs) under the influence of market requirements regarding the appropriate quality of animal production, changes in feeding technology and profitability of using individual feeds. Despite significant progress in yielding (yield increase by 54.9%) of this crop, yields are low and subject to large fluctuations. The production is sufficient to meet consumer needs, but does not ensure food self-sufficiency. There is a shortage of potatoes for starch production and this production direction should be developed (cultivation of high-starch potatoes).

The production of sugar beets increased by 2,340.9 thousand tonnes, i.e., by 19.2%, and per capita by 59.2 kg, i.e., by 18.6%. There was a dynamic increase in the production of oilseeds in total by 154.5%, and per capita by 153.0%, mainly due to the increase in the cultivation area.

In the production of vegetables, there is a regression by 195.8 thousand tonnes, with the decreasing production of field crops and increasing production of vegetables under cover. Currently, the production of vegetables under cover accounts for over 20% of the total production, which ensures the year-round supply of fresh vegetables for consumption. Vegetable production is undergoing major transformations, such as changes in the structure of crops, yields, and intended use of the production.

Fruit production is one of the dynamically developing production branches. There are changes in the cultivation area of individual tree species, varietal changes, an increase in the scale of production on farms and an increase in yields with a decreasing cultivation area. Fruit production (fruit from trees and berries) increased by 1,042.6 thousand tonnes, i.e., by 32.1%, and per capita by 26.7 kg, i.e., by 31.4%. Despite such changes in fruit production, the production is still low, and the level of fruit consumption in the country is also low. Achieving high specialization in the production of apples focused on exports with low internal consumption in the event of disturbances in export raises several economic and production problems for farmers. There is a need for export reorientation and changes in the structure of cultivated varieties (Kapusta, 2017).

To sum up, there have been significant changes in crop production, such as shifts in the level of production of the individual products, an increase in the scale of production on farms and an increase in productivity. It should be emphasized that there was a very uneven progress in crop yielding, since cereal yields increased by 26.8% in the analyzed period, potatoes by 16.5%, and oilseeds by 29.2% (Statistics Poland, 2003, 2004, 2016, 2019).

### ***3. Changes in the organization of animal production and animal productivity***

Animal production is strongly related to crop production. Feed, organic fertilizers, relatively systematic cash income for production sold, constant demand for labor without major fluctuations – these are just some of the features of this production.

This production is also subject to far-reaching changes (Table 4). The livestock population in livestock units – large units decreased by 831.0 thousand units, i.e., by 10.9%.

Table 4

*Livestock and their production*

| Description  | Average   |                    | Changes      |       |
|--|-----------|--------------------|--------------|-------|
|  | 2001-2003 | 2016-2018          | quantitative | %     |
| Livestock (thousands of large units)                                 | 7,615.3   | 6,784.3            | -831.0       | -10.9 |
| Cattle (thousand stock units)  | 5,585.3   | 6,094.3            | 509.0        | 9.1   |
| including cows (thousand stock units)                                | 2,925.3   | 2,378.3            | -547.0       | -18.7 |
| Pigs (thousand stock units)  | 18,139.4  | 11,348.7           | -6,790.7     | -37.4 |
| Sheep (thousand stock units)   | 342.2     | 259.0              | -83.2        | -24.3 |
| Horses (thousands stock units)                                       | 402.8     | 185.0 <sup>a</sup> | -217.8       | -54.1 |
| Poultry – hens, cocks, and broiler (fowls)<br>(thousand stock units) | 77,494.0  | 16,442.7           | 61,051.3     | 78.8  |
| Production of livestock for slaughter<br>(thousand tonnes)           | 4,420.3   | 6,863.0            | 2,442.7      | 55.3  |
| Production of livestock for slaughter<br>per capita (kg)             | 115.7     | 178.6              | 62.9         | 54.4  |
| Cow's milk production (million liters)                               | 11,537.0  | 13,313.3           | 1,776.3      | 15.4  |
| Cow's milk production per capita (liters)                            | 301.9     | 346.5              | 44.6         | 14.8  |
| Production of hen eggs (million)                                     | 8,724.3   | 11,137.3           | 2,413.0      | 27.7  |
| Production of hen eggs per capita (pcs.)                             | 228.3     | 289.8              | 61.5         | 26.9  |

<sup>a</sup> in 2016

Source: Statistics Poland, 2005, 2017, 2019; author's own calculations.

Cattle population in stock units increased by 509.0 thousand head, i.e., by 9.1%, while the cow population decreased by 547.0 thousand head, i.e., by 18.7%. This is the effect of reducing the number of cows aimed at improving their productivity and developing meat-type cattle rearing, which results in an increased population. The following changes take place in dairy cattle (Kapusta, 2013b, pp. 191-193): reducing the number of farms keeping cows and reducing the number of cows, increasing the scale of production, improving cows' milk yield. As a result, milk production increases by 1776.3 million liters, i.e., by 15.4%, and per capita by 44.6 l, i.e., by 14.8%. The directions of changes are by all means desirable and similar to the changes occurring in other EU countries.

Significant changes are observed in the case of pig farming, as the population decreased by 6,790.7 thousand head, i.e., by 37.4%. This results from many factors, and some of them are large fluctuations in the profitability of farming, lack of sufficiently developed piglet rearing and largely reliance on imported livestock, changes in breeding technology, and more and more frequent resignations from pig breeding by small producers. Despite the poorly developed cooperation of pig

producers and processing plants, the livestock purchase index is systematically increasing (Kapusta, 2013a, p. 70). However, the low and often variable profitability of production comes to the fore.

Sheep and horse farming is a vanishing direction of production. Sheep farming is disappearing due to the low productivity of domestic herds and low quality of wool, and the consumption of sheep meat has not been popularized, despite its multiple qualities. In turn, horse farming is declining mainly because of changes in the technology of agricultural production, i.e., the conversion of live tractive force into mechanical one. Nowadays, horse farming is mainly used to develop recreation and partly meat production, while for draft purposes it is of marginal use.

In the analyzed period, there was a dynamic development of poultry farming in general, especially poultry – hens, cocks, and broilers (fowls) (Kapusta, 2011) with meat and laying purposes (egg production). Poland has specialized in production and a significant part of it is exported. This can explain the fact that in the discussed period the population of poultry increased by 61,051.3 thousand pcs., i.e., by 78.8%. The production of hen eggs increased by 2,413.0 million pcs., i.e., by 27.7%, and per capita by 61.5 pcs., i.e., by 26.9%. Meat from poultry slaughter gains in significance in total meat production, with a decline in pig and sheep farming. The production of live animals for slaughter per capita increases by 62.9 kg, i.e., by 54.4%.

The structure of meat produced in % changed (data for 2003 and 2018): beef from 9.9 to 11.1, pork from 60.6 to 34.7, poultry from 28.6 to 53.4, other (horse, sheep, goat, and rabbit) from 0.9 to 0.8 (Statistics Poland, 2004, p. 467; 2019, p. 480). The productivity of animals increased in the form of daily gains of slaughter animals, milk yield of cows, and laying of hens. For example, the milk yield of cows increased from 3,969 to 5,747 liters, i.e., by 44.8%, and the laying of hens from 203 to 217 eggs per laying hen, i.e., by 6.9% (Statistics Poland, 2003, p. 467; 2019, p. 481).

#### **4. Changes in the efficiency of agriculture**

Several changes were found in the field of agricultural efficiency (Table 5).

The most important are:

- 1) Increase in the productivity of production factors: a) land productivity measured by production per 1 ha of UAA is increasing: global production by 123.7%, final production by 155.4%, and net final production by 147.6%; b) productivity of fixed assets, measured by the production value per PLN 1,000 of fixed assets, is increasing; global production by 45.9%, and net final production by 61.5%; c) labor productivity measured by the output per 1 AWU also increases: global production by 42.2%, and net final production by 68.1%.
- 2) Marketability of agriculture measured by the market output is increasing: a) per 1 ha of UAA – market output by 168.4%, net market output by 165.5%, per 1 AWU – net market output by 192.2%, the share of market output in global production increases by 12.5 percentage points.

- 3) Profitability of agriculture measured by the gross value added production increases: per 1 ha of UAA by 185.7%, per 1 AWU by 209.4%, per PLN 1,000 of fixed assets by 186.4%.

To sum up, productivity, marketability, and profitability of agriculture are increasing (Kapusta, 2017).

Table 5

*Changes in agriculture efficiency*

| Description                                    | Average   |           | Changes      |          |
|--|-----------|-----------|--------------|----------|
|  | 2001-2003 | 2014-2018 | quantitative | %        |
| Productivity of production factors (PLN and %) |           |           |              |          |
| a) land: GP/1 ha UR                            | 3,387.7   | 7,577.0   | 4,189.3      | 123.7    |
| FP/1 ha UR                                     | 2,466.6   | 6,299.3   | 3,832.7      | 155.4    |
| NFP/1 ha UR                                    | 2,117.9   | 5,243.6   | 3,125.7      | 147.6    |
| b) fixed assets: GP/PLN 1,000 fixed assets     | 520.5     | 759.5     | 239.0        | 45.9     |
| NFP/PLN 1,000 fixed assets                     | 325.4     | 525.6     | 200.2        | 61.5     |
| c) labor: GP/AWU                               | 27,302.0  | 66,133.0  | 38,831.0     | 42.2     |
| NFP/AWU  | 17,068.5  | 45,767.2  | 28,698.7     | 68.1     |
| Marketability: MO/1 ha UR                      | 2,108.2   | 5,657.9   | 3,549.7      | 168.4    |
| NMO/1ha UR                                     | 1,759.5   | 4,670.7   | 2,911.2      | 165.5    |
| NMO/1AWU                                       | 14,180.1  | 41,434.5  | 27,254.4     | 192.2    |
| MO/GP 100                                      | 62.2      | 74.7      | 12.5         | 12.5 pp. |
| Profitability: GVA/1 ha UR                     | 1,073.0   | 3,065.5   | 1,992.5      | 185.7    |
| GVA/AWU  | 8,647.1   | 26,756.1  | 18,105.0     | 209.4    |
| GVA/1,000 PLN fixed assets                     | 164.9     | 307.3     | 142.4        | 186.4    |

Explanation of abbreviations: GP – global production, FP – final production, NFP – net final production, MO – market output, NMO – net market output, GVA – gross value added.

Source: Statistics Poland, 2005, 2017, 2019; author's own calculations.

## 5. Changes in food self-sufficiency

Changes in food self-sufficiency have been characterized on the example of five products that play an important role in feeding the population, i.e., cereals, potatoes, cow's milk, hen eggs, as well as meat and offal. The results are summarized in Table 6.



Table 6

*Changes in food self-sufficiency*

| Description                               | Average   |           | Changes      |           |
|---|-----------|-----------|--------------|-----------|
|   | 2001-2003 | 2016-2018 | quantitative | %         |
| 1. Cereals                                |           |           |              |           |
| a) Consumption (thousand tonnes)          | 5,834.7   | 4,840.3   | -994.4       | -17.0     |
| b) Share of consumption in production (%) | 23.0      | 16.4      | -6.6         | -6,6 pp.  |
| c) Share of imports in consumption (%)    | 23.9      | 49.5      | 25.6         | 25.6 pp.  |
| d) Share of exports in production (%)     | 1.9       | 19.8      | 17.9         | 17.9 pp.  |
| e) E-I balance(thousand tonnes)           | -921.7    | 3,495.7   | 4,417.4      | x         |
| f) Self-sufficiency indicator             | 95.7      | 119.7     | 24.0         | 24.0 pp.  |
| 2. Potatoes                               |           |           |              |           |
| a) Consumption (thousand tonnes)          | 5,046.0   | 3,800.0   | -1,246.0     | -24.7     |
| b) Share of consumption in production (%) | 25.6      | 44.7      | 19.1         | 19.1 pp.  |
| c) Share of imports in consumption (%)    | 6.0       | 15.5      | 9.5          | 9.5 pp.   |
| d) Share of exports in production (%)     | 1.9       | 10.7      | 8.8          | 8.8 pp.   |
| e) E-I balance (thousand tonnes)          | 70.6      | 322.0     | 2,51.4       | 180.8     |
| f) Self-sufficiency indicator             | 100.4     | 92.5      | -7.5         | -7.5 pp.  |
| 3. Cow's milk                             |           |           |              |           |
| a) Consumption (million liters)           | 9,992.3   | 9,959.7   | -32.6        | -0.3      |
| b) Share of consumption in production (%) | 86.6      | 74.8      | -11.8        | -11.8 pp. |
| c) Share of imports in consumption (%)    | 2.9       | 17.6      | 14.7         | 14.7 pp.  |
| d) Share of exports in production (%)     | 17.5      | 33.3      | 15.8         | 15.8 pp.  |
| e) E-I balance (million liters)           | 1,729.3   | 2,683.0   | 953.7        | 55.1      |
| f) Self-sufficiency indicator             | 108.0     | 123.3     | 15.3         | 15.3 pp.  |
| 4. Hen eggs                               |           |           |              |           |
| a) Consumption (thousand tonnes)          | 438.3     | 259.0     | -179.3       | -40.9     |
| b) Share of consumption in production (%) | 89.6      | 41.2      | -48.4        | -48.4 pp. |
| c) Share of imports in consumption (%)    | 0.5       | 10.0      | 9.5          | 9.5 pp.   |
| d) Share of exports in production (%)     | 3.3       | 46.8      | 43.5         | 43.5 pp.  |
| e) E-I balance (thousand tonnes)          | 14.0      | 268.3     | 254.3        | 1,816 pp. |
| f) Self-sufficiency indicator             | 102.9     | 159.8     | 56.5         | 56.5 pp.  |
| 5. Meat and offal                         |           |           |              |           |
| a) Consumption (thousand tonnes)          | 2,911.3   | 3,188.3   | 277.0        | 9.5       |
| b) Share of consumption in production (%) | 89.6      | 59.3      | -30.3        | -30.3 pp. |
| c) Share of imports in consumption (%)    | 2.9       | 27.5      | 24.6         | 24.6 pp.  |
| d) Share of exports in production (%)     | 8.7       | 51.9      | 43.2         | 43.2 pp.  |
| e) E-I balance (thousand tonnes)          | 198.4     | 1,914.0   | 1,715.6      | 8,647.2   |
| f) Self-sufficiency indicator             | 107.1     | 168.6     | 61.5         | 61.5 pp.  |

Source: Statistics Poland, 2005, 2017, 2019, 2020; author's own calculations.

It was found that:

- 1) The consumption of: cereals decreased by 17.0%, potatoes by 24.7%, cow's milk by 0.3%, and hen eggs by 40.9%, while the consumption of meat and offal increased by 9.5%.
- 2) The share of consumption in production is decreasing for cereals by 6.6 percentage points, cow's milk by 11.8 percentage points, for hen eggs by 48.4 percentage points, and meat and offal by 30.3 percentage points, while in the case of potatoes it is increasing by 19.1 percentage points, which was due to a large reduction in potato production in general (less cultivation area and less harvest).
- 3) The share of imported production increases in relation to the volume of consumption: basic cereals by 25.6 percentage points, potatoes by 9.5 percentage points, cow's milk by 14.7 percentage points, hen eggs by 9.5%, and meat and offal by 24.6 percentage points.
- 4) The share of exports in production is increasing for cereals by 17.9 percentage points, potatoes by 8.8 percentage points, cow's milk by 15.8 percentage points, hen eggs by 56.5 percentage points, and meat and offal by 43.2 percentage points.
- 5) Balance of exports over imports increased across all analyzed products: potatoes by 180.8%, cow's milk by 55.1%, hen eggs by 1,816.4%, and meat and offal by 8,647.2%.
- 6) The self-sufficiency indicator of products increased: for cereal by 24.0 percentage points, cow's milk by 15.3 percentage points, hen eggs by 56.5 percentage points, and meat and offal by 61.5 percentage points, while it decreased in the case of potatoes and was negative– 7.5 percentage points (Kapusta, 2017).

In summary, there was an improvement in food self-sufficiency in the four discussed types of products and worsening in the case of potatoes. At the same time, the connection between Polish production and the world market was stronger, as evidenced by an increase in the following indicators: the share of imports in consumption and the share of exports in production.

### **Position of Polish agriculture in the European Union**

In the analyzed period, there was an increase in the number of countries – members of the European Union, therefore Poland's share in the total area of the Union decreased from 7.9% (2004 and 2005) to 7.2% (2010 and 2019), including agricultural land from 10.6% and 10.9% to 7.7%, and Poland was ranked 5th in the EU in both areas. In turn, Poland's share in the population was 8.3% (2004 and 2005) and decreased to 7.2% (2010 and 2019), and the position remained the same (6th). In turn, in terms of the number of persons employed in agriculture, Poland's share increased, and it took 1st and 2nd position (Table 7) (Kapusta, 2017).

Table 7

*Share and position of Polish agriculture in the European Union*

| Description                           | Poland's share (%)<br>(25 countries) |                   | Position of Poland<br>(25 countries) |                | Poland's share (%)<br>(28 countries) |      | Position of Poland<br>(28 countries) |                |
|---------------------------------------|--------------------------------------|-------------------|--------------------------------------|----------------|--------------------------------------|------|--------------------------------------|----------------|
|                                       | 2004                                 | 2005              | 2004                                 | 2005           | 2010                                 | 2019 | 2010                                 | 2019           |
| Area                                  | 7.9                                  | 7.9               | 5                                    | 5              | 7.2                                  | 7.2  | 5                                    | 5 <sup>c</sup> |
| – including agricultural land         | 10.6 <sup>a</sup>                    | 10.9 <sup>b</sup> | 5 <sup>a</sup>                       | 5 <sup>b</sup> | 7.7                                  | 7.7  | 5                                    | 5 <sup>c</sup> |
| Population                            | 8.3                                  | 8.3               | 6                                    | 6              | 7.7                                  | 7.7  | 6                                    | 6              |
| – including employment in agriculture | 19.4 <sup>a</sup>                    | 19.4 <sup>a</sup> | 1 <sup>a</sup>                       | 1 <sup>a</sup> | 18.6                                 | 17.8 | 2                                    | 2              |
| Production:                           |                                      |                   |                                      |                |                                      |      |                                      |                |
| Cereals:                              |                                      |                   |                                      |                |                                      |      |                                      |                |
| – wheat                               | 7.2                                  | 6.9               | 4                                    | 4              | 6.8                                  | 7.1  | 4                                    | 5              |
| – rye                                 | 43.5                                 | 44.2              | 1                                    | 1              | 38.8                                 | 34.6 | 2                                    | 2              |
| – barley                              | 5.8                                  | 6.5               | 6                                    | 6              | 6.4                                  | 5.4  | 5                                    | 6              |
| – oats                                | 16.5                                 | 17.5              | 1                                    | 1              | 20.0                                 | 15.1 | 1                                    | 2              |
| Potatoes                              | 21.2                                 | 18.5              | 1                                    | 2              | 14.8                                 | 14.3 | 2                                    | 3              |
| Sugar beet                            | 9.8                                  | 8.8               | 3                                    | 3              | 9.5                                  | 12.0 | 3                                    | 3              |
| Rapeseed and turnip rape              | 10.9                                 | 9.3               | 3                                    | 4              | 10.8                                 | 11.0 | 4                                    | 3              |
| Apples                                | 20.2                                 | 17.1              | 1                                    | 3              | 17.8                                 | 28.9 | 2                                    | 1              |
| Tobacco                               | 8.3                                  | 7.6               | 4                                    | 4              | 12.7                                 | 19.2 | 3                                    | 2              |
| Pork                                  | 9.1                                  | 8.9               | 4                                    | 4              | 7.8                                  | 8.9  | 4                                    | 4              |
| Cow's milk                            | 8.4                                  | 8.7               | 4                                    | 4              | 8.3                                  | 7.3  | 4                                    | 5              |
| Hen eggs                              | 8.2                                  | 8.4               | 7                                    | 7              | 9.2                                  | 9.2  | 7                                    | 7              |
| Cattle population                     | 6.1                                  | 6.2               | 7                                    | 7              | 6.4                                  | 7.0  | 7                                    | 6              |
| Pig population                        | 11.2                                 | 11.8              | 3                                    | 3              | 9.9                                  | 7.9  | 3                                    | 6              |
| Total for 14 features                 | x                                    | x                 | 49                                   | 53             | x                                    | x    | 51                                   | 54             |
| Average position                      | x                                    | x                 | 3.5                                  | 3.8            | x                                    | x    | 3.6                                  | 3.9            |

<sup>a</sup> 2002; <sup>b</sup> 2003; <sup>c</sup> 2018.

Source: Statistics Poland, 2005, 2006, 2020.

Basically, Polish agriculture has a stable position in the European Union; the positions range from 3.5 to 3.9.

If we take Poland's position (5th) in terms of agricultural land as a reference point for further analysis, it was ranked higher in the case of almost all crops, and in some of them in the second analyzed period it improved its position, e.g., in apple production, or strengthened its current position (e.g., wheat, barley, sugar beet, tobacco).

In animal production, Poland maintained its current position in cattle population, while its position deteriorated in pig population (from 3 to 6). As a result of the increase in animal productivity, the positions in the production of beef and veal (from 8 to 7) improved, the position in the production of pork (7) and hen eggs (7) were maintained, and Poland's position in the production of poultry meat (7) increased significantly (from 6 and 4 to 2 and 1), while the position in the production of cow's milk deteriorated (4 and 4 to 4 and 5) (Kapusta, 2017).

Changes in the volume of exports and the balance of trade in agricultural and processing products are a synthetic measure of changes in Polish agriculture and, more broadly, in the food economy. It was previously stated that Poland for the first time in the period after World War II achieved a positive balance in 2003. In the analyzed fifteen years (2001-2003 and 2016-2018), exports of agri-food products increased from EUR 3,464.9 to 81,862.3 million, i.e., by EUR 78,397.4 million, imports increased from EUR 3,573.3 to EUR 56,609.9 million, i.e., by EUR 53,036.6 million, and the balance changed from EUR 108.4 to EUR 25,252.4 million euro. It is worth emphasizing that trade turnover is constantly growing, and the balance is improving in 2014 – EUR 6,921.2, in 2015 – EUR 7,818.1, in 2016 – EUR 7,039.7, in 2017 – EUR 8,527.5, and in 2018 – EUR 9,684.2 million (*Handel zagraniczny...*, 2002-2004; 2015-2019). Trade turnover with EU countries is high; over 80% in exports and approx. 70% in imports.

### Conclusions

The analysis of changes in Polish agriculture from 2001-2003 and 2011-2013 showed positive trends in its development and the maintenance of a high and stable position among EU countries. Changes in the structure of fixed means of production, improved quality of labor resources, improved Poland's self-sufficiency in terms of basic agricultural products and efficient farming management deserve special emphasis. Foreign trade turnover of agri-food products is constantly increasing, and the balance of trade is improving. Negative phenomena include managing agricultural land – high dynamics of withdrawing land from agricultural production, little progress in transforming the area of farms and a very low level of calcium fertilization, which requires urgent state interference. The position of Polish agriculture in the EU generally ranks proportionally to the land resources or higher. However, it is weaker in the case of animal production compared with crop production. Particular emphasis should be given to trade turnover in agri-food products, systematic increase in trade turnover and positive balance.

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## PIĘTNAŚCIE LAT ROLNICTWA POLSKIEGO W UNII EUROPEJSKIEJ

### Abstrakt

*Celem opracowania było scharakteryzowanie: a) pomocy finansowej wypłacanej rolnikom w ramach wspólnej polityki rolnej i źródeł pochodzenia środków w latach 2004-2018; b) przemian w rolnictwie w zakresie: czynników produkcji, powierzchni upraw oraz produkcji głównych ziemioplodów ogółem oraz na 1 mieszkańca, chowu zwierząt gospodarskich oraz produkcji głównych produktów zwierzęcych ogółem oraz na 1 mieszkańca, produktywności (ziemi, pracy i środków trwałych), towarowości i dochodowości (ziemi, pracy i środków trwałych), samowystarczalności w zakresie produkcji i zużycia: zbóż, ziemniaków, mleka krowiego, jaj kurzych oraz mięsa i podrobów. Jako okres bazowy do porównań przyjęto lata 2001-2003, tj. trzylecie przed akcesją Polski do Unii Europejskiej, natomiast ostatni okres to lata 2016-2018, ze względu na dostępność zweryfikowanych informacji statystycznych; c) plasowania się rolnictwa polskiego w UE w latach 2004-2005 (UE-25) oraz 2010 i 2019 (UE-28).*

*Stwierdzono pozytywne zmiany we wszystkich omawianych zagadnieniach, z wyjątkiem gospodarowania ziemią, której wyłączenie z produkcji rolniczej wymaga pilnej ingerencji państwa w celu zmniejszenia tempa tego procesu. Pozycja polskiego rolnictwa w UE na ogół plasuje się proporcjonalnie do zasobów ziemi lub wyżej. Słabsza pozycja jest w produkcji zwierzęcej niż w roślinnej. Systematycznie wzrastają obroty handlowe produktami rolno-żywnościowymi oraz dodatnie saldo handlowe.*

**Słowa kluczowe:** wspólna polityka rolna, dopłaty, produktywność, samowystarczalność, plasowanie.

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