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Agricultural company and agricultural holding towards climate and agricultural policy changes (3)

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All the authors are the researchers from the Institute of Agricultural and Food Economics – National Research Institute.

The work has been prepared under the topic **Farms and agricultural enterprises in the face of climatic change and changes in the agricultural policy.**

It is the third out of five publications devoted to functioning of agricultural enterprises and farms under conditions of changes in climate and the anticipated change in agricultural policy which is expected to take place in 2021 and beyond – its performance in the next several years.

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FROM THE AUTHORS[1]

At the beginning of the first decade of this century, improved farming conditions could be observed in Polish agriculture. It was then that PHARE and SAPARD, co-financed by the European Union, were launched to provide funds for the development of the food sector. Despite relatively small amounts, these programs played – as it turned out afterwards – an important role in adapting this sector of Polish economy to production conditions which were to prevail upon Poland's accession to the European Union.

Getting access to the European Union market was of enormous importance to Polish food producers, as this market had been safeguarded by customs and non-tariff barriers. This was a very large market on which Polish producers could demonstrate their comparative advantages, as the costs of most of Polish food products were lower than those in the EU-15 countries.

In the first years after the accession, the level of vertical integration of agriculture with processing was low, yet constantly growing, but requirements imposed by companies processing products of animal origin led to changes in agricultural production structures while maintaining a fairly stable size structure of farms. EU subsidies calculated at constant prices were then much more significant than those offered under PHARE and SAPARD. These funds contributed to the further increase in the competitiveness of the domestic food sector and agricultural development, which was more sustainable than before.

Progress in quantitative terms and better quality of products coupled with favorable price changes resulted in the fact that the total revenue generated in the six-year period of 2010-2015 by domestic agriculture, calculated in current prices, was higher by 80.3% than that generated in the six-year period before the accession (1998-2003). Thus, the calculated total income of agricultural producers was higher by 283.2%. However, as much as 49.1% of income was attributable to subsidies, whose share increased in the compared periods by 39.6 percentage points (p.p.). Effects calculated at current prices were not that impressive. The calculated total revenue generated by domestic agriculture was, e.g. greater by 11.2% annually on average in the six-year period of 2010-2015 than in the six-year pre-accession period (1998-2003).

Transformations taking place in Polish agriculture coincided in the analysed period with unfavorable climate change whose consequences started to be felt in the 1980s, the effects of the third wave of globalization which started in 1980 and events taking place in the European Union from 2008 onwards.

[1] The initial part of this fragment of the monograph was partially taken from the study by W. Józwiak [2014, pp. 16-17, 47-48, 52, 54-57].

When considering the phenomena, the increased uncertainty as regards farming may be forecast. This uncertainty is additionally escalated by the aging of the Polish population, which will intensify the outflow of people from rural areas.

To answer the question about the impact of the phenomena on the further evolution of domestic agriculture until 2025, a research project entitled "Farms and agricultural enterprises in the face of climatic change and the changes in the agricultural policy" was undertaken in 2015 under a multiannual governmental program "The Polish and the EU agricultural sectors 2020+. Challenges, opportunities, threats and proposals", which is to be implemented by 2019. This monograph presents the results of the third stage of the implementation of this project, hence its title which is similar to the title of the whole research project with an appendix [3]. The results of the three-year research carried out to date and those of research to be conducted in 2018 and 2019 will be the basis for developing a summary paper which will be published in 2019.

Chapter 1 of the monograph contains the research results and consists of four subchapters. The first two ones include the results of projections of socio-economic and economic trends which determine the framework in which Polish farms will be operating by 2025. The third subchapter shows the condition of the European Union in the next financial framework, with particular emphasis on the share of expenditure on the common agricultural policy and the cohesion policy in the EU budget. The last subchapter contains the characteristics of changes in the condition of domestic agriculture in 2004-2015, compared to the six-year period preceding the accession, presented using gross value added calculated at constant prices. The projection of the used time series with empirical data enables to relate the findings also to the years 2016-2019. The subchapter ends with the information about the reason for changes in the value of this measure.

The subsequent chapters of the monograph further investigate and thus also update the characteristics of selected aspects of agricultural activity. Such an approach required that the authors use source materials relevant to a given issue and specific methods of its analysis.

Chapter 2 discusses the issues related to the operation of farms varying in size. In 2016, the focus was on small farms, part of which showed features typical of agricultural households. This year, issues related to medium-sized farms, i.e. ones with SO of EUR 15-25 thousand[2] were analysed. Analysis to be performed in 2018 will cover large agricultural enterprises.

[2] SO (standard output) is a farm's output as measured by the coefficient method. The coefficients include regionally differentiated average five-year prices for the sale of specific products in the area of

Chapter 3 characteristics of domestic farms operating in different natural and organizational conditions are presented. The subject of research in 2015 were issues related to the economic condition of agricultural entities operating in areas under threat of drought in the crop-growing seasons. The corresponding chapter of the last year's monograph presented the results of an analysis covering farms located in less favoured areas (LFA), whereas this monograph presents the results of an analysis carried out to evaluate the operation of farms afforesting part of their agricultural land.

In Chapter 4 the analysis of the organization and performance of Polish farms, compared to the farms in selected countries is continued. In 2015, these were farms specializing in field crops, that met the prerequisites to become competitive or already were competitive. In 2016 an analogous analysis covered horticultural farms, while in 2017 – dairy farms and live cattle farms.

As regards Chapter 5, in the monograph of 2015 it contained the major determinants of regional differences in the profitability of the production of selected agricultural products in 2014 on farms dealing with conventional production and those conducting organic production. The 2016 monograph included findings for 2015, and highlighted the role of direct production costs as a factor largely dependent on the agricultural producer. The issue of direct production costs continued to be analysed in 2017 and is discussed in the presented monograph, yet based on materials of 2016, also in the regional approach.

The monograph ends with a summary and conclusions.

the farm, excluding VAT on products and direct subsidies. The SO measure is the sum of products of these indicators and outputs of specific goods produced on the farm.

PROBLEMS THAT FARMS WILL HAVE TO FACE BY 2025

Since 2003, Poland has been an exporter of agricultural and food products, hence interest in issues relating to the operation of domestic agriculture. Due to the scope of the conducted research project, the authors of the presented monograph are obliged to extend the perspective in which these issues are analysed to the next EU financial framework.

The chapter consists of four parts. In the first two ones, the conditions of farms' operation were examined in the broadest possible social and economic context, and using two long-term trends. This allowed for formulating a general projection of farming conditions by 2025. The third part of this chapter presents an attempted projection of the operating conditions of Polish agriculture in 2025, dependent on the condition of the European Union. In the third part of this chapter, the authors focused on explaining the reasons for stagnation in gross value added calculated at constant prices, generated in Polish agriculture in 2010-2015, compared to the situation in the first six years after the accession (2004-2009). The projection revealed that this situation may prevail at least by the year 2019.

The chapter was prepared based on scientific literature on the subject concerned, selected documents of the Polish Government and of the European Union, as well as the results of studies carried out by the Institute of Agricultural and Food Economics – National Research Institute, as part of the economic accounts for agriculture.

LINEAR PROJECTION OF THE SITUATION OF THE WORLD IN ACCORDANCE WITH LONG-TERM GLOBAL SOCIAL AND ECONOMIC TRENDS[3]

In his book "Essays in Persuasion" published in 1930, John M. Keynes included an essay entitled *Economic Possibilities for our Grandchildren* [Mas--Colell 2014, pp. 143-146], in which he presented quite aptly the future of economically developed countries around the world within the next ninety years. He emphasized the purposefulness of separating short-term and medium-term trends from long-term ones in this type of studies and the purposefulness of using only the latter in long-term projections.

The Keynes' method was mentioned in essays included in a book edited by I. Palacios-Huerta and published in 2014 [2014]. These essays point to

[3] The subchapter includes corrected content of subchapter „Projekcja dwu zestawów najważniejszych długoterminowych światowych trendów społeczno-gospodarczych" from [Józwiak 2016 (d)].

various aspects of the situation of the world in 2113. Their authors believe that a reliable forecast for such a long-term perspective can be based on extrapolation of long-term trends, provided that it incorporates assumptions related to yet non-existent consequences of examined long-term trends. It is also clear to them that long-term trends may be used to develop a forecast with a shorter time horizon [Roth 2014, p. 179]. Therefore, the characteristics of the most important ten global trends in the 20th century were presented. These characteristics were prepared by Daron Acemoglu [2014, pp. 23-71], a professor of economics at the Massachusetts Institute of Technology (MIT) in the United States, and were used to show the situation of the world by 2025. The characteristics of changes in this situation are presented below.

▪ The ideas formulated in Europe in the Age of Enlightenment, which started in the 17th century, triggered a rights revolution. At first, this was an intellectual movement observed in Scotland and England, which over time developed also in France and Germany. Enlightenment is also called the Age of Reason, because its ideas began to shape a new way of thinking by the elites of those countries, which later spread onto the elites of other countries[4].

The Enlightenment thought did not create a compact system, therefore internal contradictions growing over time led to its collapse. What remained, however, were the practical effects of the Enlightenment way of thinking, which resulted to a large extent in the growing number of societies becoming involved in the election of their leaders and influencing their rule. The poor, women and religious, ethnic and sexual minorities gained citizenship rights and freedom. Domestic violence in the husband–wife and parents–children relationships started to disappear and relations in the workplace became more democratic[5]. Yet most of the world's societies continued to live under authoritarian rule of those acting in the interest of a limited number of people creating national elites.

▪ New technologies became more widespread, as they had no longer impact on the production of goods only, as was the case in the 19th century, but were increasingly more present in all aspects of social life: health, nutrition, transport, communication, housework, catering, leisure, entertainment, etc. Demand for new goods and services related to them was conducive to prosperity.

▪ The average income per inhabitant of the Earth continued to increase, except for periods of recession and economic crises as well as wars. The value of this

[4] In Poland, the Enlightenment ideas appeared in the 18th century. Their aftermath was e.g. the activity of Krzemieniec Lyceum and that of other associated schools like the School of Geometric Practitioners and the School of Mechanics, as well as various courses [Encyklopedia… 2001-2005, Vol. 15 pp. 534-535].

[5] See: [Miller et al. 2014, pp. 21-289] and [Masaaki 2014, pp. 31-176].

indicator denominated in USD and based on 2010 prices increased 2.6 times and the trend was close to linear.

▪ As the increase was not even, the gap between income earned by citizens of affluent countries and those of poor countries would increase. At the beginning of the 20th century, the multiplication factor of the ratio of the ninetieth centile to the tenth centile of the income of the various countries in the world per capita was less than 9, while now it is almost 30.

▪ Work and income transformation continued. In economically developed countries, the percentage of agricultural workers and people working in industrial sectors in the total working-age population would decrease, while that of people involved in the provision of services such as education, personal hygiene, tourism, finance, etc. would increase. At the same time, medium--skilled professions would cease to be practiced, leading to the disappearance of the middle class. This phenomenon, coupled with lack of jobs for low-skilled workers resulting from substituting human work with increasingly more efficient machines and equipment, led to polarization of income.

▪ The health revolution was underway, as evidenced by an increase in the average life expectancy from approx. 30 to 60 years due to better hygienic conditions (clean water, waste water treatment, etc.) and prophylaxis, reflected mainly in the decrease in infant and child mortality.

Discrepancies in the average life expectancy between inhabitants of economically developed countries and people living in developing countries would diminish. This phenomenon was largely due to the spread of important innovations in healthcare in developing countries, possible with financial aid from economically developed countries and efforts taken by international organizations.

▪ The world was becoming more integrated through accelerating the exchange of goods and technologies between countries, as evidenced by the share of foreign trade in the total GDP of the world's countries. In the early 20th century, this was approx. 22%, to reach approx. 40% in 2000. This increase was due to changes in the states' trade policies, offshoring and progress in communication technologies which facilitated outsourcing. The progressive integration of the world is also referred to as globalization[6].

Globalization was conducive to the development of production that required low-skilled workers in low-wage countries. As a result, the number of agricultural workers in some of these countries decreased.

[6] Gabriela Ziewiec [2012, pp. 15-17] wrote about three waves of globalisation, in 1870-1913, 1950-1973 and after 1980.

The world's integration was facilitated by the increase in the number of international financial institutions [Schiller 2014 p. 202]. In 1930, the Bank for International Settlements was established, and in 1944 – the International Monetary Fund and the World Bank. The latter evolved into the World Bank Group. The Inter-American Development Bank began operations in 1959, the Asian Development Bank in 1966, the International Swaps and Derivatives Association in 1985, and the World Trade Organization in 1994.

▪ The first half of the 20th century was filled with intense hostilities, while the other one was much calmer. In the first 45 years of the previous century, up to 200 people per 100 thousand ones died each year in battles or of wounds suffered during international armed conflicts, whereas in the following years, this ratio was not greater than 5. As regards civil wars, the annual death toll in 1912-1952 was 16 people per 100 thousand ones (the end of the epoch of colonial rule), afterwards this ratio declined to 4 or below.

However, the course of this trend in the 20th century cannot be interpreted as a transition from centuries of perpetual wars to a period of peace, as the reasons for war outbreaks are complex and are frequently due to factors that are not analysed in this paper.

▪ A trend to limit the reach of the rights revolution was observed. In the previous century, social movements emerged to prevent the spread of ideas specific for that revolution. From the 1930s to the late 1980s, movements such as fascism and communism existed. These movements devastated a number of countries and took lives of tens of millions of people. Nazism, which was the German type of fascism, was eradicated as a result of World War II, while the remains of fascism vanished with the fall of such regimes in Portugal, Spain, Greece and Latin America. There are still communist countries, yet since the late 1990s, their number has significantly decreased.

In the last 50 years, another counter-Enlightenment phenomenon occurred, namely increased importance of religion in politics. What causes serious concerns is the revival of the politicized fraction of Islam in the Muslim states in North Africa, the Middle East and South Asia. This may be a reaction of people raised in authoritarian, traditional families and communities to changes coming from the West with its alien civilization, which they find threatening to their culture. Moreover, there is a common belief in Muslim countries that the imperialist West has largely contributed to the poor development of Muslim countries.

▪ The human population would increase. The world's population increased in 1900-2000 from 1.5 to 6.9 billion people, i.e. 4.6 times, although the population of Western Europe, North America, Australia and New Zealand increased only

1.7 times. As the population grew and the economic development progressed, more readily available natural resources started running out, which led to their higher prices and unfavorable climate change on the Earth. It is known e.g. that the atmospheric concentration of carbon dioxide – one of the greenhouse gases responsible for this phenomenon – was recently 40% higher than its highest level during the last 800 thousand years [Weitzman 2014, p. 232]. The characteristics of the Earth's climate change that will be observed in the first half of this century and of their consequences, also in Poland, are described in the following papers [Kundzewicz 2013, pp. 91-106, Kundzewicz et al. 2006, pp. 169-180].

The characteristics of the ten most important trends that occurred in 1900-2000 and were described in Daron Acemoglu's essay were the basis for developing a projection of the situation of the world in 2025, which allows for cautious optimism.

Technological and economic changes in the past century, outlined above, were driven primarily by institutional improvements related to the rights revolution mentioned when characterizing the first long-term global trend. In the countries that have undergone this revolution, inclusive (incubator) economic institutions prevail. These institutions provide opportunities and incentives for the development of innovations and economic activity pursued by the largest possible part of the society. These incentives are based on the right to enjoy personal freedom and property rights and the right to their protection. The latter refers to the protections of the interests of innovators, wage earners and business people.

By adducing one of his papers, written together with G.M. Ponzetto and A. Schleifer, E.L. Glaeser [2014, p. 107] expressed an opinion that education is a key element of supporting the sustainability of democratic institutions.

Inclusive economic institutions must be supported in each country by inclusive public institutions. The capacity of the former is strengthened by equal rules of the game, such as the lack of barriers to entry into business or professional groups. This also means that the state should be centralized in such a way that the monopoly to use force in order to ensure security and the law and order in its territory is held by authorities that have been democratically chosen by the state's citizens, and not by any armed groups or dictators.

States with inclusive institutions are parliamentary democracies. States with extractive institutions (ones that divide people), referred to also as authoritarian states, are their opposite. Authoritarian states are characterized by lack of protection of property rights of part of the society, transferring income from the majority of the society to a narrow elite and rules favoring this elite (e.g. barriers to the entry into business and specific professions). Such governance conditions

are maintained by extractive political institutions which concentrate the power in the hands of representatives of a narrow interest group, and this power is neither controlled nor limited. Extractive institutions inhibit innovation and the development of technologies when these are considered to be forces destabilizing the administration or acting to the detriment of the ruling elite.

The persistence of states with extractive institutions is ensured by making citizens accept all autocratic ideas and strictly respect the hierarchies prevailing in the structures of the state, cities, settlements, villages and families, as well as workplaces.

The economy in states organized in an extractive manner grows when some branch of the economy has a comparative advantage or – more frequently – when the state starts catching up using technology transfer from economically developed countries with inclusive institutions. This may be an abrupt growth that lasts for even several decades, which puts off the transition of the existing institutions into inclusive ones, but such a situation always comes to an end.

States organized in an extractive manner undergo a transformation as a result of a rebellion involving the majority of their populations. This quite often gives way to more inclusive institutions, but at first their operation is not satisfactory, as they are set in the conditions of a long-established social hierarchy and traditional impact on the population affected by an extractive socialization system. There are thus democracies where individual freedom is not fully respected, as a result of which they are not fully inclusive democracies.

Transformations of extractive structures into inclusive ones were one of the reasons limiting the number of wars, despite the fact that such a change is sometimes the result of a civil war. The global human population growth, higher standards of living and the progressive integration of the world are also due to the increased number of inclusive institutions and resulting technological changes that lead to increased production, improved healthcare, etc. A side effect of all these phenomena is transformation of work and income, the disappearance of the middle class at a specific level of economic development and growing environmental anthropopression.

The persistence of states with inclusive institutions is ensured by the balance resulting from appreciating the interests of inventors (innovators), wage earners and business people. This is not only about the effects of growing capital and labor input, but also about a monopolistic rent resulting from emerging innovations which make it possible to improve production performance, substitute shrinking natural resources (e.g. farmland) and produce new, previously unknown, products, which stimulates demand.

There are factors, which will continue to exist by 2025, that have the detrimental effect on the rate at which the number of countries with inclusive institutions grows. One of them is the low stability of the democratic system when the education level of the majority of citizens is low, as they can be then easily manipulated by gifted politicians with autocratic tendencies. The polarization of income in liberal democracies is another such factor, as it leads to the concentration of resources and income by a small group of citizens and the dissatisfaction of unemployed people or those generating disproportionately low income. Such a situation arouses strong emotions [see also Dowbor, pp. 22--26, Kahneman 2012, pp. 526-527, Dalrymple 2016, pp. 21-303]. Such people may be encouraged by some charismatic leader to rebel against the existing social order. In countries in which extractive institutions still exist, this will be enhanced by the observable disappearance of the middle class which is the stronghold of inclusive institutions.

Strong states will protect themselves against returning to an authoritarian system by progressive taxation of salaries and profits from citizens' own funds, but such actions have their limits. These are set by free flow of capital and people between countries. It is also considered to introduce guaranteed income: in June 2016, a referendum was held in Switzerland in this regard, but Swiss citizens did not approve this idea. Some people believe that guaranteed income can be a way to reduce bureaucracy associated with granting various forms of support for people with the lowest income, and a way to ensure the minimum level of decent life. Others claim that the introduction of guaranteed income will weaken the motivation to take up work, all the more so because its economic viability will decrease as this will be accompanied by an increase in taxes.

A fast long-term rate of development in some countries with extractive institutions (for some time, e.g. China) will be the third determinant of the rate at which the number of countries with inclusive institutions will increase. This is the reason for spreading the view that enlightened authoritarianism was more conducive to economic development than parliamentary democracy. This view is obviously wrong, yet it can be partially justified. Liberal democracies act deliberately, because the process of agreeing on positions encompassing different viewpoints and developing middle-of-the-road decisions takes much time, and some citizens are not fully satisfied with thus adopted solutions. Moreover, capital accumulated in these countries is drained as a result of globalization processes to countries where hired labour is cheaper and environmental protection requirements are less stringent [Szymański 2009].

Consolidation of politicized religions, mainly in Sub-Saharan Africa and Asia, will probably be the fourth factor limiting the increase in the number of countries with inclusive institutions.

Nonetheless, the rights revolution will spread, even despite resistance, as the erosion of extractive institutions in authoritarian states is enhanced by globalization processes leading to offshoring to countries with lenient environmental protection requirements. This phenomenon will be accompanied by the process of consolidation of such states. Their governments will be authoritarian, but will ensure order attracting foreign capital for the purpose of exploiting local labour force and local raw materials.

The total global GDP will grow, but economic cycles will still occur.

Solutions are being sought to reduce the gap between the gross domestic product per capita in affluent countries and that recorded in poor ones. One such practical solution was presented in their book by William D. Eggers and Paul Macmillan [2014]. Global social problems (famine caused by climate change, shortages of potable water and accommodation, etc.) will not be resolved by governments alone, as their states are usually indebted and the level of their debts does not decline. Initiatives are thus advisable to develop economy based in the various countries on cooperation between the government, business people, charitable organizations, private benefactors and social enterprises. Thus raised funds, having been appropriated with the use of innovative technologies and cooperation methods, create new, absorptive markets.

In affluent countries, a continuous decline in the number of medium--skilled professions is reported while the number of low-skilled workers decreases due to mechanization and automation of work. At the same time, more people are trained to take up work involving the provision of services related to healthcare, nutrition and caregiving, especially to the growing number of elderly people and pensioners. This results in changes in the structure of the middle class, as it is joined by teachers specializing in new areas and individuals capable of increasing work productivity in new services.

The healthcare revolution continues and is set to continue, which we owe now and will owe within the next dozen or so years to new technologies, medicines, vaccines and better care provided to ill and elderly people. The average life expectancy will be further prolonged. The convergence trend between developed and developing countries in the area of human health revolution will probably continue.

The next dozen or so years will probably be a peaceful period due to the diffusion of the phenomenon of the rights revolution and the associated emergence of inclusive institutions. There are, however, some risks. Fascism

may revive and social movements opposing economic development in the name of concerns about the environment and the survival of at least part of the human population may emerge.

The UN forecasts show that the world population will continue to grow, albeit at a declining rate. The diffusion of innovative technologies will help meet the food needs of a growing number of people, but there will be exceptions in this respect. These exceptions will concern areas affected by international armed conflicts and civil wars in particular countries, as was the case in the 20th century[7].

International economic cooperation will become more intense and will promote the increase in the number of international financial institutions. Even in case of a political chaos, states will be able to share financial risks, as history shows us that financial agreements can survive not only a change of governments that entered into them, but also major changes in power. There will be changes in the branch structure of employment, the demand for healthcare products and services will increase, and human creativity (innovation) will help to improve production performance and labour productivity, substitute natural raw materials that are running out with new materials and develop completely new products, which will be conducive to increased demand. Income per capita will thus increase. Besides, the risk of major armed conflicts is rather insignificant.

As already mentioned, the rate of the increase in prices of inputs should be expected to accelerate due to the depletion of more accessible resources of non-renewable raw materials.

Another threat is a trend observed since 1900, which involves an increased concentration of greenhouse gases in the Earth's atmosphere and the warming of the Earth's climate which is most likely related to it, as well as the increasing percentage of excluded people in the working age population, even in economically developed countries. The foregoing can be evidenced by extreme weather phenomena, such as droughts, floods and hurricanes which occurred in a large part of Europe in the first decade of this century [Kundzewicz et al. 2006, pp. 169-170]. In parts of other regions of the world (the USA, India, Syria, Sub-Saharan Africa) these phenomena were even more intense, which may enhance emigration from those areas. We should also take into account that the occurrence of yet unknown diseases and pests endangering crop and livestock production may result in higher costs of agricultural production.

[7] Andreu Mas-Colell [2014, p. 161] reported that millions of people died of famine in China between 1927 and 1929 and about 30 million in 1958-1962. In the USSR, for the same reasons millions of people died in 1921-1922, 1932-1933 and in 1946-1947. Famine was reported also in Bengal in 1943, Bangladesh in 1974, Cambodia in 1975-1979, and North Korea in 1995-1999.

Cost-effective technologies of low-emission electricity generation and its transmission are thus being sought to reduce the adverse impact of the global community on climate. Specialists believe that approx. one third of energy used currently worldwide by households and economy can be saved, but this will not solve the problem. It is likely that this problem will be tried to be solved through further innovations reducing the cost of production of currently known but unconventional, thus expensive, ways of energy generation. Their characteristics are provided e.g. by Mariana Mazzucato [2016, p. 186].

The increased percentage of excluded people in the working-age population in economically developed countries is enhanced by the emergence of right-wing views which lead to growing authoritarian trends, even in liberal democracies.

NON-LINEAR PROJECTION IN ACCORDANCE WITH LONG-TERM GLOBAL SOCIAL AND ECONOMIC TRENDS[8]

The other long-term trend described in this chapter is related to the views of US history professors – William Strauss and Neil Howe, presented in the book "The Fourth Turning: An American Prophecy" [2007, pp. 2-22]. The authors identified a recurring cycle of changes in values professed by successive generations of people living between 1594 and 1946 in the present-day USA. These changes affected attitudes and actions taken by people.

Changes in attitudes and corresponding actions occur in a four-generation cycle (*saeculum*): the Rise, the Awakening, the Unravelling and the Social Crisis. During the Rise, individualism gets weaker, pro-social institutions are strengthened and the society is optimistic. In the next period (the Awakening), there is growing unrest caused by the consequences of the clash between the recently implemented social values and the earlier more individualistic social order. The period of the dominance of the third generation (the Unravelling) is the time of growing individualism and the weakening of existing pro-social institutions. The last turning in the generation cycle – the Social Crisis, is the time of settling unrest prevailing in human consciousness, when the set of new values quickly replaces the existing social order [Strauss and Howe 2007, p. 3]. This last phase of the generation cycle should not be confused with a crisis phase of economic cycles.

[8] The subchapter includes a corrected and suplemented part of content taken from the chapter „Projekcja dwu zestawów najważniejszych długoterminowych światowych trendów społeczno-gospodarczych" (Projection of two sets of the most important long-term global social and economic trends) [Józwiak 2016 (d)].

Since the beginning of the 19th century, the generation cycles in the USA have lasted for approx. 80 years on average, with minor variations in their duration. Each generation has its archetype (hero, artist, prophet and nomad, respectively), which suggests that the authors of the theory believe that values professed by people are shaped primarily in their consciousness. Successive generations start with turning points marked by extremely important events of national or global significance, which give rise to strong emotions and thus change the mentality of contemporary people. The value system of a given generation is influenced also by the family, friends, community and the overall social climate of the time in which it lives.

One generation includes people born within about twenty years, approximately from the birth of the first people in this generation to the birth of their first child. There are, however, several year deviations from this rule in particular countries, which result from local cultural standards and events that affect emotions of the whole generation. It happens occasionally only that dramatic events do not result in a change in the motivations of the next generation compared to those of the previous one.

In democratic countries, people begin to influence regional and national policies by participation in the first general election in their lives (they participate also when they do not vote), take up work, establish their own companies or take them over from their parents. In the next twenty years or so, they start to directly influence – together with people from the previous generation – the economy and the fate of their region or country as regional or local government officials and national level politicians, organizers of various non-governmental social structures, entrepreneurs, directors of companies, as well as writers, visionaries, teachers, professors, experts, officers, lawyers, bishops and priests and others. The third twenty-year period in the generation cycle is the time of the most intense professional and social activity. During this period, people perform their social, professional and economic roles, together with people from the next generation, to eventually retire. Then, for a few or a dozen or so years, they continue to influence the fate of their region and country by taking part in general elections.

The current *saeculum* began with the end of World War II. People born in the USA in 1901-1924, in the Rise of the cycle, experienced in their youth the consequences of a severe crisis of the 1930s. Men also fought as soldiers during World War II. Then, however, they launched the planning of the economy and rapid accumulation of material wealth, to make their country a global power. It was also the time of extended families, strong trade unions and the time when

the majority of citizens voted for a party which would defend the strong position of the state [Strauss and Howe 2007, pp. 17].

People born in 1925-1942 were characterized by foresightedness and conformism. The next generation, however, started to challenge these values. Only the third generation of the present *saeculum* – the generation of the Unravelling – definitely turned the period of self-satisfaction and optimism into a time of turbulent events resulting from the passionate quest for arguments in favour of the new social order. In 1970-1990, the US government continued to improve its planning, but people started protesting against conformism, family life became less important, people were no longer so much focused on material assets and savings, religion was abandoned. At the turn of the millennium, the US society was already strongly individualized.

After the Unravelling, a period of social crisis began. Professional ethic is less important, as spectacularly evidenced by the so-called creative accounting which largely contributed to the current economic recession which began in the USA in 2007, or even an economic crisis in some countries. There are also increasingly more opportunistic companies which maximize their adaptability to the environment at the expense of other companies. Even if they signal their openness to cooperation, "… they primarily care about getting access to other people's ideas and about their own benefits" [Hausner et al. 2017, pp. 19-21]. Americans also have a hostile attitude to the influx of immigrants. The state is weak and even the USA were unable to prevent the dramatic events of 11 September 2001. The phenomena presented above gave rise to quite widespread anxiety. The answer is the consent of US citizens to cut down certain freedoms to strengthen the role of the state.

Neil Howe and William Strauss endeavoured to prove that their findings based on American experiences apply also to countries in Western Europe, Central and Eastern Europe after the collapse of the Soviet Union and many Asian countries. The findings relating to social crisis correspond to the views of two German professors – Claus Leggewie and Harald Welzer [2012, pp. 159--197 and 200-202]. These authors point out that people are guided by present categories and private interest, which makes most of them fail to notice growing global and long-term problems.

The research conducted by Neil Howe and William Strauss shows that in the previous four periods of social crisis, various countries witnessed thorough rebuilding, or even demolition of up-to-then vigorous institutions as well as progress in armament and the tendency to use it. In the next dozen or so years, we can thus expect transformations in the social and economic life in the world,

at least in its more affluent parts, that will be more profound than those that occurred in the previous half of the century.

The picture of the world by 2025, outlined based on the Strauss-Howe generational theory, shows that policies of states (fiscal, monetary, enhancing human creativity, etc.) are likely to be unstable, as funds will be mobilized for more active social policies. There will be, therefore, no conditions favoring the development of economic activity, mainly investment, so the rate of the world's economic development is unlikely to accelerate.

The period of dominance of the current social crisis generation will end probably in the late 2020s, and then the next generation being in the Rise will began the next *saeculum*.

Preliminary outline of the EU budget for the next financial framework

European Union countries have summed up the achievements of the first years of the common agricultural policy under the current financial framework, and the EU center used these assessments to launch work in 2016 on defining the shape of this policy in the next financial framework that begins after 2020. These assessments must obviously not ignore the impact of circumstances applicable to the whole European Union which have been observed for some time. The effects of Brexit are yet unknown. Increased migration from the Middle East and North Africa has become a problem whose solution will probably require the implementation of a costly migration policy. The recently elected new US president has urged the EU countries to increase their spending on defence. Moreover, recent general elections in several UE countries revealed growing populist tendencies that can even threaten their democracies. These tendencies will force increased spending on social policies.

The need for more thorough changes in the amount and structure of EU spending is indicated in "Reflection Paper on the Future of EU Finances", developed by the European Commission and published in June 2017 (Address…, 2017). The document identifies sources of funding that will support EU budgets and specifies how these funds are to be appropriated. In the paper, mainly the other issue is addressed. It was emphasized in the document concerned that this should be done in a manner that will ensure as high EU value added as possible. The term EU value added encompasses not only beneficial effects of EU-led economic undertakings, but also the preservation and promotion of common EU values, namely democracy, freedom, the rule of law, fundamental rights, equality, solidarity and sustainable development, to ensure peace and prosperity of communities living in the Member States. Action should also be taken at the Eu-

ropean Union's level wherever it is more effective than that taken at the national, regional or local level.

The quoted document includes five scenarios of EU spending in the next financial framework.

– Scenario 1 provides for the continuation of the EU (EU-27) reform program which is currently under way, but also less spending on the cohesion and agricultural policies so as to finance new priorities: internal security, migration and better border control, defence, etc.

– Scenario 2 highlights the importance of a significant reduction in the EU budget and focuses on the operation of the internal market – trans-European networks, customs, consumer protection and agencies. The budget reduction will involve a significant reduction in spending on the cohesion and agricultural policies.

– Scenario 3 provides for a possible increase in the budget to cover the areas of joint action and assumes the same spending as in Scenario 1, as well as macroeconomic stabilization of the Euro area (investment protection, unemployment reinsurance, 'rainy day' fund).

– Scenario 4 provides for lower budgetary revenue, but also the introduction of green tax, financial transaction tax, etc., as well as reduced spending on the cohesion policy and the common agricultural policy, with focus on priorities maximizing EU value added, e.g. smart transport and energy grids.

– Scenario 5 provides for: a significantly increased budget (its reform goes beyond the assumptions provided for in Scenario 4), increased own resources ceiling of the member states and significant additional financing for new high value added priorities and external action, as well as increased spending on the common agricultural policy.

Different scenarios of the future agricultural policy are also possible, e.g. the one presented in Annex to this subchapter.

It follows from the above that four scenarios provide for reduced spending on the implementation of the common agricultural policy. In the rationale to this type of proposal it was pointed out that as a result of the policy implemented so far, inhabitants of EU countries have access to high-quality food at affordable prices. Prices of food produced in the EU are close to those on the world market, which makes exports of a significant part of EU food products viable. There are still, however, huge differences in the development of agriculture in particular Member States, which results in differences in farm income. Despite direct subsidies, insufficient income is generated by small farms, with unfavorable soil and climate conditions, as well as those situated in submontane and mountainous areas. What makes matters worse is lack of alternative income sources in nu-

merous rural areas. This poses the risk of growing social exclusion, with its all negative consequences, e.g. migration resulting in the succession of undesirable vegetation on existing agricultural land. Therefore, the reduction in EU spending on the common agricultural policy may not impair the economic situation of small and disadvantaged farmers, but quite the opposite – improve it by adjusting the level of direct payments.

Farmland occupies almost half of the EU area, so agricultural producers have a significant impact on conservation of natural resources – soil, water, air, biodiversity, as well as climate and landscape protection. Small and disadvantaged farms occupy less farmland, hence access to some form of subsidies should be provided also to larger farms, as the use of subsidies is subject to specific requirements aimed at preserving or improving the quality of natural resources. Recent events show that the EU budget has been often used to provide emergency assistance (e.g. in the case of the ban on imports of certain products to Russia). This shows that funds for the future common agricultural policy should be spent first and foremost on reinforcing tools designed to mitigate the environmental and price risks to which all agricultural producers are exposed.

More detailed characteristics of the scenarios described above confirm the foregoing. In Scenario 1, higher spending than now is to be allocated under the common agricultural policy to small farms situated in mountainous areas and sparsely populated regions. All farms will also receive support for risk mitigation, while rural development will be supported with funds appropriated for investment in agri-environmental measures. Scenario 2 provides for the same support for farms as that provided for in Scenario 1, but rural areas will not receive support for investment related to agri-environmental measures. Scenario 3 provides for the same spending on the common agricultural policy as in Scenario I. Scenario 4 provides also for reduced amounts of direct payments and focusing on small farms and those operating in mountainous areas and sparsely populated regions, while focusing also on agricultural measures reducing adverse effects of agricultural production on the environment and climate change. Moreover, all farms will receive support aimed at risk mitigation.

As already mentioned, only Scenario 5 provides for increased EU spending on the agricultural policy. As regards spending on agriculture, not only those funds that are spent on the implementation of the common agricultural policy are important, but also those appropriated for the cohesion policy, as a portion of the funds earmarked for this purpose supports indirectly desirable transformations that are under way in rural areas. It follows from the quoted document that these funds are also likely to be reduced in the next financial framework, which is provided for in all five analysed scenarios. It is assumed that the reduc-

tion in the scope of the cohesion policy in the present meaning of this word in Scenarios 1-4 will be accompanied by the implementation of the economic, social and territorial cohesion policy, focusing on undertakings reducing the scale of: social exclusion, unemployment, greenhouse gas emissions and unfavourable ecological phenomena. Scenario 1, however, provides for less EU support for investments at the regional level, which will necessitate an increase in their co-financing by Member States. Scenario 2 assumes that support under the economic, social and territorial cohesion policy will be granted only to those states that are covered by the cohesion policy and for measures fostering cross-border co-operation. Scenario 3 provides for the same spending as in Scenario 1, while Scenario 4 assumes that the economic, social and territorial cohesion policy will cover only poorer regions and undertakings fostering cross-border cooperation.

The assumptions adopted in Scenario 5 differ from those presented above, as this scenario provides that the economic, social and territorial cohesion policy is intended to reinforce only: territorial cooperation as well as the social dimension (e.g. child guarantee) and the urban dimension (perhaps the use of knowledge of the leading role of urban agglomerations in the economic development).

There has been no broader debate in Poland regarding the desirable shape of the future common agricultural policy, but work in this respect at the government level led to the adoption by the Polish Government of the document entitled "*Wspólna polityka rolna po 2020 roku – polskie priorytety*" (Common Agricultural Policy after 2020 – Polish Priorities) (Wspólna…, 2017) on 16 May 2017. The document expresses the view that the reforms of the common agricultural policy implemented to date enabled resolving various problems and were implemented in such a way as to ensure "…uninterrupted support while enhancing the market orientation of EU agriculture and extending its public functions". The document presents also the opinion that existing "… legal solutions leave room for the further modernization of the CAP [common agricultural policy], with no fundamental changes in its structure". The Polish Government intends, however, to support only such new solutions that will ensure equal conditions of competition on the EU market and equal treatment of citizens of the EU Member States, and this position is consistent with those of both Houses of the Polish Parliament. As regards agricultural issues, the government intends to seek to ensure: the same level of direct payments for agricultural producers in the Member States, stabilization of agricultural markets, measures to improve the operation of the food chain, including the protection of small farms and the introduction of more effective tools to manage production and price risks of importance to larger farms; real simplification of tools used under the common agricultural policy and better coordination of this policy with other EU policies (environmental,

cohesion, health, etc.). The quoted document presents, on nine pages, detailed criteria that the Polish Government will follow in the work on the common agricultural policy and in the next financial perspective.

A comparison of the position of the Polish Government with the previously outlined options of EU spending shows that the future shape of the common agricultural policy will require concessions. Thus, shaping this policy without knowing the position of not only Poland, but also those of other Member States, is impossible. Nonetheless, a reduction in EU spending for the common agricultural policy and the cohesion policy needs to be taken into account. The latter will limit the scope and scale of changes in the Polish countryside, and will also indirectly adversely affect Polish agriculture. It is, therefore, likely that the rate and scope of changes in Polish farms will be curtailed compared to the current situation. As a result, the rate of the increase in the number of larger competitive farms, which started after the accession, may drop after 2020 [Józwiak 2014, Józwiak 2017, Kagan 2016], which would certainly not facilitate the export expansion of the Polish agri-food sector.

CHANGES IN GROSS VALUE ADDED IN POLISH AGRICULTURE IN 1998-2015 AND THEIR REASONS, AND A PROJECTION FOR 2016-2019

As mentioned in the Introduction to this monograph, the post-accession period was characterized by a better relation of prices of agricultural products to prices of inputs purchased by agricultural producers and a growing share of subsidies in agricultural income. This obscures, however, the actual picture of economic achievements of Polish agriculture after 2004 compared to those from the pre-accession period.

Gross value added calculated at constant prices has been recognized as a good measure of the actual picture of economic achievements in Polish agriculture. In agriculture, this is an important source of funds spent on: restoring and increasing assets, remuneration for one's own work on farms run by natural persons, third-party inputs, and any funds appropriated for other purposes. The thus calculated gross value added is also one of the sources of profits in agricultural enterprises owned by legal persons.

Analyses made at the beginning of this decade [Józwiak 2012, pp. 11-45; Józwiak et al. 2012, pp. 17-20] revealed that within several years following the accession, part of farms run by natural persons and most of farms owned by legal persons were able to take advantage of the new conditions of operation and develop potential that significantly contributed to the increase in gross value

added of domestic agriculture, compared to the situation during six years immediately preceding the accession.

The purpose of this chapter is to determine whether the processes launched in six years immediately following the accession were continued in the next six-year period. It turned out that they were not continued, so an attempt was made to identify the reasons why it was so.

Analysis method

Value added of each sector of the economy is the difference between its revenue and the cost of intermediate consumption. Because these costs do not include depreciation, this measure is referred to as gross value added.

• On the revenue side, the accounts of gross value added included: the value of agricultural production, proceeds from agricultural production services rendered to other farms, the value of homemade products prepared from one's own agricultural products and the subsidies to particular products. As regards intermediate consumption, the costs of the following items should be taken into account: seeds, seed potatoes and own and purchased seedlings; energy carriers and lubricants; mineral fertilizers and soil improvement agents, pesticides, agricultural services, own and purchased feedstuffs, own products for processing, veterinary medicines and services, repairs and maintenance of machinery and buildings.
• The data were taken from economic accounts for agriculture (EAA), which are satellite accounts of some of national accounts. Since 1998, the Institute of Agricultural and Food Economics - NRI has been preparing them together with the Central Statistical Office for the European Commission. As of December 2016, these accounts covered 1998-2015. The set of EAA figures covering this period provided the nominal amounts of the value of agricultural revenue and of the cost of intermediate consumption.
• Nominal amounts of revenue and the cost of intermediate consumption derived from EAAs were converted into constant prices. To this end, materials in the possession of the Central Statistical Office, gathered by Prof. W. Ziętara since 1995, were used. Based on these materials, one-off indexes of changes in selling prices of agricultural products and inputs purchased by agricultural producers in 1998-2015 were determined, with the assumption that 2015 prices were "1".
• As the analysed period during the pre-accession period covered the six-year period between 1998 and 2003, the years after the accession were also divided into two six-year periods, i.e. 2004-2009 and 2010-2015.

• The average annual amounts of the value of agricultural revenue and the cost of intermediate consumption at constant prices were calculated, based on which the average amounts of gross value added in Polish agriculture in the defined sub-periods (six-year periods) were calculated.

Using data gathered in the form of time series, additional projections of the values of agricultural revenue and the cost of intermediate consumption were prepared by their extrapolation onto four subsequent years, which enabled determination of the gross value added at constant prices for 2016-2019. In the projection calculations, a regression model resulting in the highest values of the coefficient of determination (R^2) was adopted. These values were 0.67 and 0.47, respectively.

Gross value added in Polish agriculture in 2010-2015 compared to that in 1998-2003 and 2004-2009, and the tentative reasons for identified changes

Figures used to calculate gross value added (at constant prices) in 1998-2015 are presented in Table 1.

Table 1. Average annual values of revenue, costs of intermediate consumption and gross value added in Polish agriculture in the defined sub-periods (at constant prices)

Sub-period	Revenue in PLN billion	Costs of intermediate consumption in PLN billion	Gross value added in PLN billion	Changes in gross value added	
				1998-2003=100	Previous period = 100
1998-2003	81.5	56.2	25.3	100.0	-
2004-2009	86.7	56.8	29.9	118.2	118.2
2010-2015	89.1	59.7	29.4	116.2	98.3

Source: own calculations based on figures presented in Table 1 and Table 2.

The figures presented in Table 2 confirm the previously mentioned observations regarding a significant growth of Polish agriculture in 2004-2009. At the same time, a drop in the value of the analysed measure in 2010-2015 should be noted, although this value was still higher than in 1998-2003. This is not a new phenomenon, but is has been seldom analysed in specialist literature relating to economics and agricultural sciences. It needs to be added that different opinions are formulated as regards this issue.

This phenomenon was probably first observed by Laura Latruffe, a researcher of the Agricultural Economics Department at INRA in Rennes, France [Józwiak 2008]. Analysing income of a specific group of French farms, she real-

ized that subsidies had a negative influence on farms' performance. This is opposite to the Polish experiences, as based on the figures in Table 1, it can be inferred that the amount of revenue per a unit of intermediate consumption cost was higher throughout the analysed post-accession period than that in the pre-accession period, in spite of a decrease in this difference in the second half of this period.

Recently, Laura Latruffe has moderated her opinion [Latruffe et al. 2017, pp. 783-799]. Analysing farms specialized in milk production in 1990-2007 in eight EU countries, she observed, together with her research team, that the influence of subsidies on technical efficiencywas negative only in two analysed countries. A positive impact of subsidies was found in two countries out of the analysed ones. As regards the other countries, the research team was unable to determine this influence. The conclusions of the quoted study include a claim that decoupling, in 2003, direct payments for UE agricultural producers from the volume of their production reduced the influence of subsidies on technical efficiency of production. If this assessment is right, it can be stated that in Poland the phenomenon of weakening influence of subsidies appeared with a delay of some years.

The phenomenon in question was analysed by Włodzimierz Rembisz and his team [Bezat-Jarzębowska et al. 2012, pp. 52-59]. The authors assumed that agricultural producers are guided in their economic decisions also by specific instruments provided for the agricultural policy, e.g. the amounts of direct subsidies. A question thus arose whether this did not affect adversely the improvement of production performance, in particular, the improvement of labour productivity as a primary source of income growth. Model reasoning showed that transfers based on prices and payments increase agricultural income and also stabilize it, thus improve labour productivity. The quoted authors add, however, that subsidies "… do not have to result in improved labour productivity as the primary source of agricultural income growth". The authors of the quoted study present a belief that the aforementioned claim can be confirmed by the 2004-2009 growth in the share of subsidies in income of farms: with predominant crop production, with predominant livestock production and with mixed production.

The cited authors' findings do not diverge from the conclusion drawn from the results presented in the study [Latruffe et al. 2017, pp. 783-799]. The figures, however, raise doubts. In 2009, the nominal amount of subsidies for all beneficiaries in Poland was greater than that in 2004 by approx. 112%, thus

a change in the rates of subsidies also led to an increase of the share of subsidies in income, not only measures taken by agricultural producers. It follows from the above that measures taken on farms did not have such a profound influence as shown by the share of subsidies in income.

It cannot be ruled out that there were also some other reasons for the decline in the gross value added of domestic agriculture in the six-year period of 2010-2015 compared to the situation in the previous six-year period. Attention should be paid primarily to lower interest in livestock production demonstrated by agricultural producers. In 2010-2013, the number of Polish farms with more than 1 ha of UAA that did not pursue this production decreased from 910.8 thousand to 786.7 thousand [Characterystyka…2014, pp. 220-221 and Charakterystyka…2012, pp. 224-225], i.e. by 124.1 thousand (13.6%). This led to two-fold effects. First of all, the sale of raw materials of plant origin instead of using them in livestock production decreased value added. For example, the average gross value added generated in 2012 from milk production per 1 ha of forage area was PLN 6,399, but in the case of discontinuation of milk production and replacing cow feed production with maize grain production, this was only PLN 3,113 [Czułowska et al. 2014, pp. 3-40 and 63-75]. In this case, discontinuation of livestock farming led to a decrease in gross value added by 51.3%.

Secondly, discontinuation of animal farming by a growing number of farms resulted in insufficient organic fertilization of arable land, and consequently, decreased soil fertility [Zieliński 2012]. However, the extent of this phenomenon countrywide is unknown, as some non-livestock farms used various manure substitutes.

The decrease in gross value added was also due to the costs of meeting new cross compliance requirements by beneficiaries of direct subsidies. Since the accession, Polish farms have been obliged to ensure that their land is in good agricultural condition. In 2009-2013, a number of other requirements were imposed, e.g. ensuring conditions conducive to animal welfare. In the first six-year period, the costs of intermediate consumption incurred to meet additional cross compliance requirements were low. It was estimated based on constant prices that the average annual increment of these costs increased from PLN 75 million in 2009 [Niewęgłowska 2011] to PLN 966 million in 2014 [Józwiak et al. 2013, pp. 123-138], which meant an increase of 1.5% in the amount of the costs of internal consumption of the whole domestic agriculture.

The degression of the rates of part of subsidies for farms with large areas contributed to a large extent to a decrease in the rate of extending the area of

land leased from the Agricultural Property Agency of the State Treasury. In 2004-2009, the Agency let each year 62.5 thousand ha on average, but in the last analysed six-year period this figure was only 27.3 [Buks et al. 2016, p. 40]. Therefore, it took more time for land used in an insufficiently effective manner to be taken over by farms which were developing and increasing their assets, hence operating effectively.

The situation as regards the sale of land administered by the Agricultural Property Agency of the State Treasury was different. In 2004-2009, the Agency sold each year 100.5 thousand ha on average, while in 2010-2015, this figure was 116.7 thousand ha [Buks et al. 2016, p. 23]. This means that farms would invest their financial means in land so as not to be dependent on the effects of sudden changes in the state land lease policy, even at the expense of other business ventures. It is not possible to present more detailed characteristics of this phenomenon due to the scarcity of relevant information.

The analysed phenomenon could also be due to the manner in which agricultural producers made their decisions. As early as in the 19th century, Alexis de Tocqueville, the political scientist, formulated a view that democracy is strong when people combine thinking about business with thinking about values. This concept is shared by the contemporary Swiss economist H.Ch. Binswanger [Józwiak 2014, p. 22]. Binswanger believes that capitalists resign in specific circumstances from a portion of their profits due to ethical and environmental considerations. This short list of considerations may be increased with one more, namely that relating to behavioral economics, according to which not all agricultural producers maximize their economic surplus, as some of them are satisfied with lower, but also less risky income [Józwiak 1990]. These could be people with a risk aversion, probably older ones and with no successors, seeking income abroad, etc. The partial agricultural census carried out in 2013 [Charakterystyka… 2014, p. 358] revealed that approx. 30 thousand farms (2.1% of the total) did not carry out agricultural production, but only tried to maintain agricultural land in a condition making it eligible for subsidies.

There is one more reason for the decline in gross value added (at constant prices) in Polish agriculture in 2010-2015 that needs to be considered. As the bulk of generated gross value added is appropriated for subsistence of agricultural producers and their families, the decrease in the value of this measure should be correlated with a decline in family labour input. During the eighteen years from 1998 to 2015, the average annual rate of the decrease in the number of such people (in full-time equivalent) was approx. 1.4%, but it was not the

same throughout this period. In the six-year period between 1998 and 2003, this number decreased by 19.0%, in 2004-2009 – by 3.7%, while in 2010-2015, a slight increase by 0.3% was even recorded. The decline in gross value added (at constant prices) in 2010-2015 was thus accompanied by a slight increase in the number of agricultural workers. Therefore, the decline in gross value added (at constant prices) cannot be explained by the decrease in the number of agricultural workers in Poland.

Table 2. The amounts of revenue, intermediate consumption and gross value added in Polish agriculture (at constant prices) in 2010-2015 and a projection for 2016-2019 (average annual amounts)

Period	Revenue in PLN billion	Costs of intermediate consumption in PLN billion	Gross value added in PLN billion
2010-2015	89.1	59.7	29.4
2016-2019[a]	92.1	62.2	29.9

a. The results of the projection of the time series in the 1998-2015 period onto 2016-2019.
Source: calculations made by Z. Mirkowska based on EAA data and selected figures from Table 1.

The results of the calculations made to prepare a projection of the analysed phenomenon for 2016-2019 show that the average annual amount of agricultural revenue will increase by a slightly greater amount than the increase in the costs of intermediate consumption (Table 2). As a result, the average annual gross value added (at constant prices) will be 1.7% higher than that in the six--year period between 2010 and 2015, and the same – as shown in Table 1 – as that in 2003-2009. It can be thus assumed that a marked increase in gross value added (at constant prices) which was recorded in the six-year period after the accession (2004-2009) will continue, with minor changes, until 2019.

There are probably several reasons for the stagnation of gross value added (at constant prices) generated by domestic agriculture after 2010. These were presented below, whereby the order in which they are organized does not reflect their importance, as there was no information based on which such an assessment could be made. Below, the above-mentioned reasons for the decline in gross value added (at constant prices) of Polish agriculture are presented.

• At least every seventh producer abandoned livestock production, which led to a reduction by even half in the amount of gross value added. This phenomenon occurred mainly on small farms with low income which forced their operators to seek its other sources, mainly off-farm employment.

• The decline in gross value added (at constant prices) of Polish agriculture was attributable also to direct subsidies. Agricultural producers abandoned production generating high value added if another type of production generating lower value added but supported through subsidies and the effects of the economic situation allowed the farm to generate higher income.
• The course of the analysed phenomenon was also affected by higher costs that had to be incurred to meet new cross compliance requirements by beneficiaries of direct subsidies. Since the accession, Polish farms have been obliged to maintain their land is in good agricultural condition. In 2009-2013, new requirements were, however, imposed, e.g. the requirement to ensure conditions conducive to animal welfare, which resulted in higher costs.
• There are also premises that at least every fiftieth agricultural producer chose risk-free income and abandoned agricultural production to pursue only those activities that were eligible for subsidies. In most cases, the reason could be an intrinsic or developed risk-aversion, an illness or other random events, being at the pre-retirement age and having no successor, etc.
• It should be furthermore assumed that the rate of the increase in the number of farms enlarging and modernizing their assets was lower in the six-year period between 2010-2015 than in the six-year period immediately after the accession. The reason could be the degression of the rates of subsidies for farms with large areas and the unstable national policy regulating lease and sale of state land. This phenomenon can be confirmed, e.g. by a marked reduction in the area of land leased from the Agricultural Property Agency of the State Treasury and growing sales of land from this source. The latter meant blocking spare funds owned by farms, as a result of which farmers had to resign from other profitable undertakings.
• The decline in gross value added (at constant prices) in 2010-2015 was not caused by the decrease in the number of Polish agricultural workers.

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EVALUATION OF THE DEVELOPMENT CAPACITY OF MEDIUM-SIZED FARMS IN THE CONTEXT OF CLIMATE CHANGE AND ECONOMIC POLICY

Medium-sized farms separate small farms from large ones. Small farms are characterized – compared to middle-sized ones – by a smaller area of agricultural land and lower spending on consumable inputs, but greater labour input per area unit of used land. This is the reason for the low productivity of the latter factor of production, which results in low income per labour input unit. As a result, owners of small farms have limited interest in enlarging and developing their farms, and seek income sources primarily out of their farms. In the literature on the subject one may find an opinion that such farms are just about to decline [Wojewodzic 2010, pp. 53-76], as well as information about the role of non-agricultural income in the lives of families of small farms' owners [Augustyńska-Grzymek 2011, Józwiak 2015, Józwiak 2016(c)].

As to large farms, they produce in a cost-effective way and provide large quantities of goods with properties desirable on the market, while significant labour productivity ensures a decent standard of living and funds.for extended reproduction of held production assets. Farms have to increase their production or substitute work with capital to maintain farm income per labour input unit at least close to the average wage in the national economy. Only such farms are taken over without any reluctance by successors. Such an opinion can be found e.g. in [Józwiak 2014], [Fresco et al. 2016] and [Dudek 2016, pp. 6 and 9-12].

Only a small proportion of small farms decide, in favorable circumstances, to increase production, and if this increase if large enough, they join the group of medium-sized farms. The situation in the latter size group is similar. Part of farms increase production by intensifying labor input and/or lowering the standard of living of the farm owner and his family to gain financial resources that will enable these farms to join the large farm group. The analysed situation is illustrated by figures in Table 1.

It follows from Table 1 that in 2010-2013, medium-sized farms were ones with SO of EUR 15-25 thousand. In this period, approx. 14 thousand of them increased the number of larger farms, and a similar number of smaller farms joined the group of medium-sized farms.

Table 1. Changes in the number of domestic farms[a] run by natural persons, which differ in the economic size (2010-2013)

Farm size SO in EUR thousand	Number of farms in thousand in:		Changes in the number of farms:	
	2010	2013	in thousand	%
Up to 4	758.3	657.6	-100.7	-13.3
4-8	273.2	260.5	-12.7	-4.6
8-15	193.8	182.3	-11.5	-5.9
15-25	111.9	112.1	0.2	0.2
25-50	93.2	107.1	13.9	14.9
50 and more	49.8	71.5	21.7	43.6
Poland total/average[b]	1,480.2	1,391.1	-89.1	-6.0[b]

a. The table accounts for the change in the number of farms caused by a correction of the definition of a farm in 2013.
b. Weighted average.
Source: own findings based on [Charakterystyka… 2012, pp. 384-385] and [Charakterystyka… 2014, pp. 18, 75-76 and 358-359].

What was so specific, therefore, about farms with SO of EUR 15-25 thousand that they set a boundary between size categories in which the number of farms decreased and those in which this number increased? The answer to this question is provided later in the chapter.

Analysis method

Medium-sized farms were analysed by comparing them to small and large farms, excluding the largest ones. Information used in the analysis was derived primarily from the results of the partial agricultural census of 2013 [Charakterystyka… 2014, pp. 358-371]. This information covers farms with agricultural land of more than 1 ha, excluding those that carried out agricultural activity but abandoned agricultural production. This agricultural activity involved operations eligible for subsidies.

The outcomes of the census do not include figures on farms' net and gross income, nor the family labour input for the farm's production. Therefore, these amounts were estimated based on figures derived from the Polish FADN monitoring results (Table 2). These estimates were based on the assumption that the amounts presented in it, determined according to the Polish FADN monitoring results expressed in SO amounts, correspond to the analogous average figures relating to farms, presented in the outcomes of the partial 2013 census.

On this basis:

● gross farm income was calculated as the sum of net income and depreciation,

● family labour (in FWU) was calculated as the product of the total labour in AWU, derived from the census outcomes, and the ratio of family labour in the total labour calculated based on the figures presented in Table 1.

Table 2. Selected characteristics of farms of different sizes, operated by natural persons in 2013

Measure and indicator	Farm size in SO of EUR thousand:		
	up to 15[a]	15-25	25-50
Average farm size by SO (in EUR thousand)	5.5	19.8	36.4
Farm income (in PLN thousand per farm)	9.3	28.1	57.4
Depreciation amount (in PLN thousand per farm)	7.8	16.6	26.2
Share of hired labour in the total labour (%)	15.2	20.6	26.9
Cost of hired labour (PLN/hour)	9.0	8.7	8.5

a. This group of farms includes also farms with SO of up to EUR 4 thousand, with respect to which relevant amounts were estimated by extrapolating the figures relating to groups of farms with the size of:

Source: calculations made by M. Zieliński based on the Polish FADN monitoring results and own findings.

● Net and gross income per FWU. These findings were then related to the average wage rates of hired agricultural workers, presented in Table 1, and to the parity rate (the average national wage rate) which in 2013 amounted to PLN 13.79 per hour [Augustyńska-Grzymek… 2014, p. 20]. The results of these findings are presented in Table 3.

The amount of net income per FWU is the remuneration for family labour where simple reproduction of held assets takes place in the farm, whereas the amount of gross income per FWU is the remuneration for this work where the farm assets consumed in the production process are not reproduced.

Net income per FWU higher that the parity wage attests to generated profit which is remuneration for own capital invested in the farm. However, the rate of profit, i.e. its relation to own capital, was not measured.

● Counting labour input in hours per hectare of agricultural land it was assumed that one full-time worker (AWU) works on the farm for 2120 hours per annum.

Definitions of other measures and indicators used in this subchapter can be found in [Charakterystyka… 2014, pp. 18-19, 21-22 and 27-34].

Situation of medium-sized farms[9]

In 2010-2013, the number of medium-sized farms (SO of EUR 15-25 thousand) operated by natural persons was almost the same as mentioned above. This group of farms was characterized by a simultaneous increase and decrease in the number of farms at an approximately the same level. As regards small farms, these were characterized by an decrease in their number, which was accompanied by an increase in the number of large farms.

Resources of production factors, land productivity and the organization of medium-sized farms were different from those typical of farms with SO of up to EUR 15 thousand (Table 3). Approximately two thirds of their operators had agricultural education, i.e. 28.6 p.p. more than in the case of small farms. Medium-sized farms had almost three times larger area of agricultural land whose productivity was higher by 16.7%. Employment in full-time equivalent was 60.6% higher, albeit lower by 45.0% per agricultural land unit. In terms of the value of output per agricultural land unit, this indicates a significantly higher level of substituting work with capital than in the case of small farms.

Almost two thirds of the analysed farms had also a large or very large share of livestock production in the total value of their output. The share of such farms was higher by 26.9 p.p. on average than that of small farms. This indicates a significantly higher value added in medium-sized farms, as part or even most of their crop production was processed on the same farms.

Labour productivity (performance) in medium-sized farms was slightly higher than the average labour productivity in Poland, but more than two times higher than on small farms, i.e. ones with SO of up to EUR 15 thousand. Slightly more than three fourths of medium-sized farms could thus be the primary source of income for their owners and their families. This was thus 40.4 p.p. more than the average in Poland and 53.0 p.p. more compared to small farms. Significantly fewer (by 30.7 p.p.) families of medium-sized farms' owners generated additional income from salaried work, and even to a lesser extent from non-agricultural business activity and pensions and annuities, by 4.2 and 12.9 p.p., respectively.

[9] There is virtually no contemporary literature on the subject. The only references refer to the paper entitled: „Gospodarstwa rodzinne – dylematy i kierunki rozwoju" (Family farms – dillemas and development directions). Its author [Józwiak 2017] believed that the decline in the number of farms, recorded worldwide, is a complex process.

Table 3. The number of farms and characteristics of production factors, land productivity and the structure of farms operated by natural persons, differing in size expressed in SO (as of 2013)

Measure and indicator	Domestic values, total or average	of which farms with SO of EUR thousand:		
		up to 15	15-25	25-50
Number of farms (in thousand)[a]	1,391.1	1,100.4	112.1	107.1
Share (%)	100.0	79.1	8.1	7.7
Area of agricultural land (ha/farm)	9.3	4.7	14.0	23.7
Employment (number of full-time workers per farm)	1.3	1.1	1.8	2.1
Employment per ha of agricultural land (hours)	296	496	273	188
Percentage of farm operators with formal agricultural vocational training (%)	47.7	39.0	67.6	73.5
Agricultural land productivity (SO of EUR thousand per ha)[a]	1.5	1.2	1.4	1.5
Percentage of farms:				
▪ with specialist production:				
– crop	55.5	61.3	34.4	22.2
– livestock	13.8	8.4	24.8	30.2
▪ mixed	30.7	30.3	40.8	47.6

a. The average EUR exchange rate of the National Bank of Poland in 2013 was PLN 4.1975, so land productivity was: PLN 6,296, PLN 5,037, PLN 5,876 and PLN 6,296, respectively.

Source: modified and supplemented Table 4 from [Józwiak 2016(a)].

Table 4. Labour productivity and structure of income generated by owners of farms being natural persons, differing in size expressed in SO (as of 2013)

Measure and indicator	Average values in Poland	of which farms with SO of EUR thousand:		
		up to 15	15-25	25-50
Labour productivity (SO of EUR thousand per full-time worker in the farm)[a]	10.6	5.0	11.0	17.3
Percentage of families of farm owners with income from:				
▪ agricultural activity, in excess of half of total income	34.9	22.2	75.2	75.3
▪ from[b]:				
- non-agricultural business activity	15.2	16.1	11.9	10.2
- salaried work	49.8	58.1	27.4	16.3
- pension or annuities	30.9	34.3	21.4	17.0

a. The average EUR exchange rate of the National Bank of Poland in 2013 was PLN 4.1975, so labor productivity (performance) was: PLN 44.5 thousand, PLN 21.0 thousand, PLN 46.2 thousand and PLN 72.6 thousand, respectively.

b. The sum of percentage values does not have to be 100%.

Source: as in the case of Table 3.

In Table 5 below, estimated average net and gross agricultural income per FWU is presented and related to wages of agricultural workers and to the average wage in the national economy (parity wage).

Figures characterizing income of farms from family labor for one year need to be commented on. It was further found that entrepreneurial income calculated Poland-wide in economic accounts for agriculture (EAA) was in 2013 significantly higher than income determined based on the trend prevailing in the eight-year period of 2008-2015. Evaluations based on analysis of estimated income presented in this subchapter may thus be too optimistic to be extrapolated onto subsequent years. They are secondary to evaluations based on the results of the 2013 census, yet conclusions drawn on this basis should be considered as preliminary ones.

Figures included in Table 5 show that the average annual net income of a farm with SO of EUR 15-25 thousand per hour of family labor amounted in 2013 to PLN 9.3, i.e. 6.8 p.p. more than the agricultural worker's wage, but 32.3 p.p. less than the parity wage. With such remuneration for family labor, the farm's owner has financial resources allowing for reproducing assets consumed in the production process.

Table 5. Estimated average net and gross income per hour of family labour of farms operated by natural persons, differing in production volume, and evaluation of this income (as of 2013)

Indicator	Farm size in SO in EUR thousand:		
	up to 15	15-25	25-50
Income in PLN per hour of family labour:			
- net income	5.8	9.3	17.6
- gross income	9.8	14.7	25.7
Net income in PLN per hour of family labour in relation (%) to:			
- agricultural worker's wage	65.1	106.8	207.0
- parity wage	42.1	67.7	128.0
Gross income in PLN per hour of family labour in relation (%) to:			
- agricultural worker's wage	110.1	169.0	302.3
- parity wage	56.6	71.3	187.0

Source: corrected Table 5 from [Józwiak 2016(a)].

Medium-sized farms' owners and their families did not have thus to seek additional sources of income from work in other farms. It was justifiable, however, to take up salaried work where wage rates were higher than income from family labor in one's own farm.

It was also worthwhile to increase the output volume in case of favorable farming conditions (a better economic situation, subsidies resulting from the im-

plemented agricultural policy[10]) The objective was, however, to achieve a permanent increase in the held production assets that would be big enough to qualify the farm to the group of large farms, i.e. ones with SO of at least EUR 25-50 thousand. This ensured income per FWU higher by 28 p.p. than the parity wage rate (the average wage for hired labor in Poland), as well as capacity to carry out simple reproduction of held assets. Where income per FWU was the same or even lower than the parity wage rate, it was advisable to invest in expanded reproduction of held production assets.

Abandoning simple reproduction of held non-current production assets also increased income, which the family of a medium-sized farm's owner could spend on improving the standard of living. This could, however, impair the farm's sustainability. Such a solution was justifiable only where the farm's owner was just about to retire and had no successor.

The relatively favourable situation of medium-sized farms was acknowledged by owners of small farms which were in a much worse situation. With simple reproduction of held assets, farms' owners and their families generated income per FWU which was significantly lower (by 34.9 p.p. on average) than the agricultural worker's wage rate. It is thus more advisable to seek paid work, even on neighbouring farms.

Besides, part of small farms' owners abandoned reproduction of assets consumed in the production process. By doing so, they could generate income per FWU higher than the agricultural worker's wage rate, but no investment in reproduction of non-current assets consumed in the production process resulted in depreciation of held assets, leading eventually to the loss of all non-current production assets, of course except for the land. In such a case, livestock production was abandoned, but crop production was continued, which required family labour and own current assets as well as purchased ones. Production services were also purchased. This situation reduced, however, the farm's value added. For example, substituting in 2012 milk production per hectare of forage area with maize grain production led to a 51.2% decrease in gross value added [Czułowska et al. 2014, pp. 31-40 and 63-86]. Discontinuation of livestock production resulted thus in a significant decline in income of the farm.

It was worthwhile to take measures to increase the value of agricultural output to such an extent as to qualify the farm as at least a medium-sized one. The results of a study dealing with small but exceptionally economically active farms

[10] Such as „Plan rozwoju obszarów wiejskich obejmującego lata 2004-2006" (Rural Development Plan for 2004-2006), „Sektorowy program operacyjny – Restrukturyzacja i modernizacja sektora żywnościowego oraz rozwój obszarów wiejskich 2004-2006" (Sectoral Operational Program – Restructuring and Modernization of the Food Sector and Rural Development 2004-2006) and „Program rozwoju obszarów wiejskich na lata 2007-2013" (Rural Development Plan for 2007-2013).

are described in [Żmija 2016]. The author analysed in his study farms located in the Małopolskie Voivodeship, with an area of agricultural land of 1-5 ha, which received direct payments in 2004-2015 and received at least once support for investment. The author sent a survey questionnaire to 350 so defined farms, selected with the use of a probabilistic sampling technique, to receive 296 correctly completed forms, hence approx. 11% more than the minimum sample size.

Table 6. Education level of farm operators in 2015 in the sample analysed by D. Żmija, compared to the average national data from 2013, covering farms with the same area of agricultural land

Education level	Percentage of farm operators:		Difference in p.p.
	in the sample analysed by D. Żmija[a]	average national values according to the Central Statistical Office[b]	
Higher	27.7	11.0	16.7
Secondary	40.5	33.0	7.5
Primary and lower secondary	7.1	14.4	-7.3
Basic vocational	24.7	38.0	-13.3
Primary without graduation and no school education	-	3.6	-3.6
Total	100.0	100.0	0.0

Source: [Żmija 2016, p. 119] and [Charakterystyka… 2014, p. 240].

The level of education of farm operators from the sample selected by the quoted author was higher than that of the average Polish farmer operating farms with the same size (Table 6). This undoubtedly resulted in better economic results. It was estimated that the average income of Polish farms with an agricultural land area of 1-5 ha amounted in 2013 to PLN 10.3 thousand [Józwiak 2016(a)], while income generated by the described farms amounted in 2015 to PLN 55.5 thousand on average, i.e. only 3.3% less than the average 2013 income of farms with SO of EUR 25-50 thousand, covered in 2013 by Polish FADN monitoring. It follows from the foregoing that part of the analysed small farms undertook and implemented measures which enabled them to be qualified as not only medium-sized farms but even larger ones.

Besides, as much as 73.6% of families of the analysed farms' owners generated in 2015 more than half of their total income from agricultural production. A similar share (75.2% and 75.3%, respectively) was recorded in middle-sized farms with SO of EUR 15-25 and 25-50 thousand covered by the census conducted by the Central Statistical Office in 2013.

The analysed farms were measured by their agricultural land areas (this was 3.8 ha on average). However, when measured by SO, the analysed group of farms included in 2015 also middle-sized farms or even larger ones. This indicated that measures taken on these farms in 2004-2015 were in most cases successful and led to a significant increase in their size by SO, which enabled them to generate higher income.

The key to success achieved by farms analysed by Dariusz Żmija was using aid funds offered after 2004 to change the production structure and probably also taking advantage of marketing rules. Changes in the production structure helped to a large extent to specialize in crops yielding high income per agricultural land unit. Approximately 22% of the farms specialized in the production of ground vegetables, and about 20% – in crops under cover. Their share in the total volume of such production in Poland was obviously smaller, and in 2013 this was 5.8 and 0.5%, respectively.

Based on the above observations, it can be concluded that in the group of small farms, consisting mainly of "floating" and "end-of-life" farms, there was a small subgroup of farms which were able, in favorable circumstances, to increase their production value to such an extent that they could be qualified as medium-sized farms or even larger ones.

A phenomenon similar to that analysed by Dariusz Żmija is likely to have occurred also in medium-sized farms.

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EFFICIENCY OF FARMS AFFORESTING LAND AGAINST A BACKGROUND OF OTHER FARMS IN 2006-2014

Introduction

In Poland, an important difficulty for farms wishing to conduct the effective agricultural production are often the adverse natural farming conditions, as evidenced by the average agricultural production area valorisation (APAV) index amounting to 66.8 points (pts) per 120 achievable points[11,12]. What is more, in 18.2% (456) of communes and 32.9% (17.7) of cadastral districts the average APAV index is lower than 52 pts[13]. This indicates that these areas are characterised by particularly difficult natural conditions to conduct the agricultural production. These lands, due to their low suitability for agriculture, may therefore be a potential area for afforestation.

In Poland, in the years 2004-2015 the forest cover increased from 28.7 to 29.5%, i.e. by about 0.8 percentage points (p.p.)[14, 15], of which 0.3 p.p. accounted for afforestation carried out as a part of the European Union (EU) Common Agricultural Policy (CAP)[16]. This means that a large impact on the increased forest cover in Poland is exerted by afforestation supported under the EU CAP. This is particularly important both in the context of meeting the objectives of the National Programme for the Augmentation of Forest Cover (NPAFC), which assumes that by 2020 Poland should achieve the forest cover at the level of 30% and for potential participation of the LULUCF sector in an effort to limit the greenhouse gas emissions from the Efford Sharing Regulation (ESR) after 2020[17,18].

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[11] Jadczyszyn J., Kopiński J., Kuś J., Łopatka A., Madej A., Matyka M., Musiał W., Siebielec G., *Agriculture in specific areas.* Agricultural Census 2010, CSO, Warsaw 2013.

[12] The APAV index includes the factors affecting the quality of natural farming conditions such as: soil quality, hydrographic conditions, relief and agroclimate. Each of them has the importance proportionate to its impact on the yield of crops. The APAV index calculated as a total of these factors may have the maximum value of 120 pts [CSO 2013].

[13] Data from the Institute of Soil Science and Plant Cultivation - NRI (ISSPC-NRI) in Puławy.

[14] *Forestry 2016*, CSO, Warsaw 2016.

[15] *Forestry 2010*, CSO, Warsaw 2010.

[16] Under the RDP 2004-2006, 2007-2013 and 2014-2020 (as of 31.12.2016), afforestation covered 78.1 thousand ha of land, including 98.7% of afforestation under the RDP 2004-2006 and 2007-2013. The average afforestation area on the farms of beneficiaries of the afforestation measure under the RDP 2004-2006 was 4.4 ha, under the RDP 2007-2013 in the Scheme I and II, respectively, 2.3 and 1.5 ha, and under the RDP 2014-2020 – 1.8 ha (as of 31.12.2016). [FundEko for the MARD 2016, MARD 2009, Kryszk, Kurowska 2016, Zieliński 2017, ARMA data].

[17] Proposal for a Regulation of the European Parliament and of the Council *on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry into the 2030 climate and energy framework and amending Regulation No 525/2013 of the European Parliament and the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change* [EP 2016].

[18] In Poland, the category of afforested land is the second large source of CO_2 sequestration in the LULUCF sector (the first large source of CO_2 sequestration in the LULUCF sector is the category of

The objective of this chapter is to assess the functioning of two groups of farms from the same communes, that continuously kept accounts for the Polish FADN in the years 2006-2014. The first group comprised the farms which carried out afforestation as part of the measure *Afforestation of agricultural land* under the Rural Development Plan 2004-2006 (RDP 2004-2006), and the second one – the farms which in the analysed period did not carry out afforestation under RDP 2004-2006, 2007-2013 and 2014-2020.

Method

The analysis uses the data from 15 farms carrying out afforestation as part of the measure *Afforestation of agricultural land* (afforestation measure) under the RDP 2004-2006 and 64 other farms from the same communes which were constantly monitored for the Polish FADN in the years 2006-2014.

Map 1. Communes with the farms of beneficiaries of the afforestation measure under the RDP 2004-2006 which continuously kept accounts for the Polish FADN in the years 2006 – 2014

Source: own study based on the data of the Polish FADN 2006- 2014.

The analysis included the farms of beneficiaries and other farms from 15 communes in Poland, which accounted for 1.0% of the communes with farms of all beneficiaries of the afforestation measure under the RDP 2004-2006. Among

forest land). In 2015, in Poland afforested land absorbed 2.7 million tonnes of CO_2 which accounted for 9.0% of CO_2 sequestration in total from the LULUCF sector. As a result, in 2015 afforestation reduced greenhouse gas emission expressed in CO_2 equivalent by 0.9% [KOBiZE 2017].

them, the following farms have been identified: from four communes of the Mazowieckie Voivodeship (Baboszewo, Górzno, Regimin, Stupsk), from three communes of the Wielkopolskie Voivodeship (Chocz, Miasteczko Krajeńskie, Wolsztyn), from two communes of the Łódzkie Voivodeship (Szczerców, Dmosin), and from one commune of the Kujawsko-Pomorskie Voivodeship (Koronowo), Lubelskie Voivodeship (Stężyca), Podkarpackie Voivodeship (Wojaszówka), Podlaskie Voivodeship (Puńsk), Pomorskie Voivodeship (Gardeja) and Zachodniopomorskie Voivodeship (Szczecinek) (Map 1, Table 3).

As mentioned in the introduction, the average APAV index in Poland amounts to 66.8 points per 120 achievable points, but it is territorially diversified. In 58.6% of the communes it is lower than 66.8 points, of which in 18.2% of the communes it is lower than 52 points. In the remaining 41.4% of the communes it is from 66.8 to 108.3 points (commune of Żórawina) (Table 1). Disadvantaged in this respect are the communes with the farms of all beneficiaries of the afforestation measure under the RDP 2004-2006. In their case, the average APAV index is, in fact, 63.7 points. In addition, in 62.2% of the communes it is lower than the national average, and in 19.9% it is lower than 52 points (Table 1). In the worst situation in this respect are the communes with the farms of beneficiaries of the afforestation measure under the RDP 2004--2006 which continuously kept accounts for the Polish FADN in the years 2006--2014. In those communes, the average APAV index amounts to, in fact, 60.3 points. In 80.0% of the communes, it is lower than the national average, and in 20.0% it is lower than 52 (Tables 1 and 3).

Table 1. Characteristics of the average APAV index (pts) and the share of the communes with the average APAV index lower than 52 and 66.8 pts in Poland and in the communes with the farms of all beneficiaries of the afforestation measure and those continuously keeping accounts for the Polish FADN in the years 2006-2014

Specification	Average APAV index (pts.)	Share of the communes (%) with the average APAV index lower than	
		52 pts	66,8 pts
Poland	66,8	18,5	58,6
Communes with the farms of all beneficiaries of the afforestation measure under the RDP 2004-2006	63,7	19,9	62,2
Communes with the farms of beneficiaries of the afforestation measure under the RDP 2004-2006 which continuously kept accounts for the Polish FADN in the years 2006-2014	60,3	20,0	80,0

Source: own study based on the data from the ARMA, ISSPC-NRI and from the Polish FADN of 2006--2014.

As previously mentioned, the forest cover is 29.5%[19]. In the voivodeships, it ranges from 21.3% (Łódzkie Voivodeship) to 49.2% (Lubuskie Voivodeship)[20]. However, in the case of the communes it ranges from 0[21] to 88.0% (commune of Cisna)[22] (Table 2). In the communes with the farms of all beneficiaries of the afforestation measure under the RDP 2004-2006, this situation is slightly different. In the case of these communes, the average forest cover is, in fact, 28.8% and ranges from 0.3 (Skalbmierz) to 86.0% (Płaska). In turn, in the communes with the farms of beneficiaries of the afforestation measure under the RDP 2004-2006 which continuously kept accounts for the Polish FADN in the years 2006-2014, the average forest cover is 25.7%. The smallest forest cover is in the commune of Dmosin, where it is 9.2%. The biggest forest cover is, in turn, in the commune of Chocz – 41.5% (Table 2 and 3).

Table 2. Characteristics of the forest cover (%) and its diversification in the communes in Poland and in the communes with the farms of all beneficiaries of the afforestation measure under the RDP 2004-2006 and those continuously keeping accounts for the Polish FADN in the years 2006-2014

Specification	Average forest cover (%)	Diversification of the forest cover (%) in the communes
Poland	29,5	0 – 88,0
Communes with the farms of all beneficiaries of the afforestation measure under the RDP 2004-2006	28,8	0,3 – 86,0
Communes with the farms of beneficiaries of the afforestation measure under the RDP 2004-2006 which continuously kept accounts for the Polish FADN in the years 2006-2014	25,7	9,2 – 41,5

Source: as in Table 1.

In a comparative assessment of the identified groups of the farms of beneficiaries and other farms, account was taken, in the first place, of their return on equity and technical efficiency index. The return on equity is defined as a ratio of profit on equity to the value of this equity. Profit on equity was defined as a difference between total revenues and total costs plus contractually calculated costs of own labour of farmers and their family members. The cost of own labour has been adopted on a basis of the average remuneration level in the

[19] Data for 2015 [CSO 2016].
[20] *Forestry 2016*, CSO, Warsaw 2016.
[21] In Poland, forest land is not owned by 15 urban communes and 1 urban-rural commune (commune of Gręboszów) [data of the ISSPC-NRI].
[22] Data of the ISSPC-NRI in Puławy.

national economy in the years 2006-2014. In the analysed period, this remuneration was PLN 11.6/hour[23].

Table 3. Characteristics of the average APAV index (pts) and forest cover (%) in the communes with the farms of beneficiaries of the afforestation measure under the RDP 2004-2006 which continuously kept accounts for the Polish FADN in the years 2006-2014

Voivodeship	Commune	Average APAV index (pkt.)	Forest cover (%)
Mazowieckie	Baboszewo	65.3	11.8
	Górzno	62.2	29.6
	Regimin	69.7	25.2
	Stupsk	51.4	16.1
Wielkopolskie	Chocz	44.8	41.5
	Miasteczko Krajeńskie	62.1	27.4
	Wolsztyn	53.1	36.2
Łódzkie	Szczerców	49.2	33.8
	Dmosin	55.8	9.2
Kujawsko-Pomorskie	Koronowo	73.4	32.3
Lubelskie	Stężyca	59.7	21.4
Podkarpackie	Wojaszówka	76.7	30.2
Podlaskie	Puńsk	50.7	9.7
Pomorskie	Gardeja	74.3	20.2
Zachodnio-Pomorskie	Szczecinek	55.6	40.3

Source: own study based on the data from the ISSPC-NRI and from the Polish FADN of 2006-2014.

The technical efficiency index has been set based on the parametric method of Stochastic Frontier Analysis (SFA)[24]. This index has been determined as a quotient of the actual effect with the achievable desired effect, which could be achieved by the farm with the unchanged level of incurred expenses. In this

[23] Augustyńska-Grzymek I., Cholewa M., Skarżyńska A., Ziętek I., Dziwulski M., *Production, costs and income of selected agricultural products in the years 2006-2007*, IAFE-NRI, Warsaw 2008; Augustyńska–Grzymek I., Cholewa M., Dziwulski M., Ziętek I., *Production, costs and income of selected agricultural products in the years 2007-2008*, IAFE-NRI, Warsaw 2009; Augustyńska–Grzymek I., Cholewa M., Dziwulski M., *Production, costs and income of selected agricultural products in the years 2008-2009*, IAFE-NRI, Warsaw 2010; Augustyńska–Grzymek I., Cholewa M., Jabłoński K., Żekało M., *Production, costs and income of selected agricultural products in the years 2009-2010*, IAFE-NRI, Warsaw 2011; Abramczuk Ł., Augustyńska–Grzymek I., Czułowska M., Jabłoński K., Żekało M., *Production, costs and income of selected agricultural products in the years 2010-2011*, IAFE-NRI, Warsaw 2012; Abramczuk Ł., Augustyńska–Grzymek I., Czułowska M., Jabłoński K., Żekało M., *Production, costs and income of selected agricultural products in the years 2011 -2012*, IAFE-NRI, Warsaw 2013; Abramczuk Ł., Augustyńska–Grzymek I., Czułowska M., Jabłoński K., Żekało M., *Production, costs and income of selected agricultural products in the years 2012-2013*, IAFE-NRI, Warsaw 2014; Abramczuk Ł., Augustyńska–Grzymek I., Czułowska M., Jabłoński K., Żekało M. *Production, costs and income of selected agricultural products in the years 2013-2014*, IAFE-NRI, Warsaw 2015.

[24] Kumbhakar S. C., Lovell C.A., *Stochastic Frontier Analysis*, Cambridge University Press, 2004.

method, the technical efficiency index ranges from 0 to 100.0%[25, 26]. In assessing the functioning of the identified groups of the farms of beneficiaries and other farms, also the information about the following has been used:

1. production potential:
   - UAA expressed in ha, consisting of: own land, land leased for one year or longer, land used on a basis of joint harvest with the owner, as well as fallow land and set-aside land,
   - share of land leased in the UAA, expressed in %,
   - own soil valuation index (pts),
   - share of own UAA with V and VI soil valuation class in the UAA (%),
   - total labour inputs per 1 ha of UAA, involving total human labour input as part of the operational activity of the farm, specified in hours[27],
   - share of paid employment in total labour inputs (%),
   - average capital value;
2. production organisation:
   - share of arable land (AL) in the UAA (%),
   - share of cereals in AL (%),
   - share of wheat in sown cereals (%),
   - share of oat and rye in total in sown cereals (%),
   - share of green manure in AL (%),
   - share of farms not applying calcium fertilisers in the analysed period (%)
   - stocking density of animals, expressed in livestock units per 1 ha of AL (LU/ha);
3. production effects, productivity, economic efficiency and development opportunities:
   - wheat yield (dt/ha),
   - oat and rye yield (dt/ha),
   - milk yield of cows (kg/cow/year),
   - land productivity (PLN/ha of UAA) determined as a ratio of the total on-farm production value to the UAA,

[25] In modeling using the SFA method, the form of the Cobb-Douglas production function has been applied, for which the statistical significance was obtained for all parameters of the deterministic model estimated by the least squares method and of the stochastic model estimated by the maximum likelihood method. As a category of effect, to design the model total revenues plus operational aid (PLN) have been adopted, while in terms of inputs: own and hired labour inputs expressed in AWU, value of agricultural land (PLN), fixed assets inputs expressed as depreciation (PLN) and total costs less depreciation and remunerations (PLN). What is important, the model included the factor likely to affect the technical inefficiency of the analysed farms. In this analysis such a factor is the variable: *own soil valuation index*.

[26] In the model using the SFA method, the occurrence of the technical inefficiency has been tested using the likelihood ratio test, by comparing the obtained result with the test critical value for α=0.05.

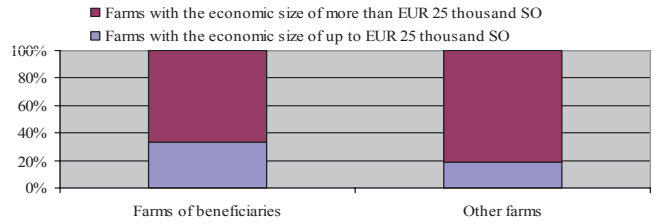
[27] According to the Polish FADM methodology, until 2010 one AWU (FWU) amounted to 2,200 working hours while since 2011 it is equal to 2,120 hours [Polish FADN 2011, 2012 and 2014].

– capital productivity (%) determined as a ratio of the total on-farm production value to the average capital value,
– labour productivity (PLN/AWU) determined as a ratio of the total production value to the number of AWU,
– farm income (thousand PLN) and farm income without subsidies for land afforestation (thousand PLN)[28, 29],
– fixed assets reproduction rate (%) determined as a ratio of net investment to the value of fixed assets including agricultural land, farm buildings, forest plantings, machinery and equipment, as well as animals of the breeding herd.

Structure of the analysed farms of beneficiaries and other farms

In the case of farms of beneficiaries and the other farms, the percentage structure of farms with the economic size of up to EUR 25 thousand and more than EUR 25 thousand SO was different (Chart 1). In both cases, the less significant group in this comparison were the farms with the economic size of up to EUR 25 thousand, however, this group was more important in the case of farms of beneficiaries, where its share was 33.3%. As regards other farms, the share of this group of farms was 18.8%.

Chart 1. Percentage structure of the analysed farms of beneficiaries and other farms in the years 2006-2014 by their economic size (SO)



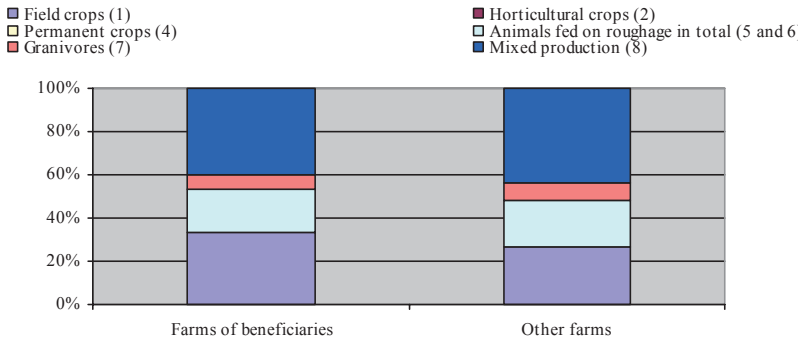
Source: as in Map 1.

[28] The analysis determined whether those farms, in terms of income and income without afforestation aid, were significantly statistically different from each other. To examine the significance of differences, the Mann–Whitney U nonparametric test has been used. This test was used as the distribution of compared variables differed from the regular distribution (Shapiro-Wilk test for $p < \alpha = 0.05$) [Stanisz 2007a, 2007b].

[29] The analysis included land afforestation aid in a form of afforestation support as well as forest maintenance and afforestation payment.

The percentage structure of types of farming (TF8) in both analysed groups of farms was similar (Chart 2). In the farms of beneficiaries and other farms, the leading role was played by mixed farms, which accounted for, respectively, 40.0 and 43.7% of all analysed farms. Next, were the farms with field crops, whose share amounted to, respectively, 33.3 and 26.6% as well as the farms with animals fed on roughage in total[30] with the share of, respectively, 20.0 and 21.9%. The smallest share, representing respectively 6.7 and 7.8% was that of the farms with animals fed on concentrated feed.

Chart 2. Percentage structure of the analysed farms of beneficiaries and other farms in the years 2006-2014 by type of farming (TF8)



Source: as in Map 1.

Assessment of the functioning of the analysed farms of beneficiaries against a background of other farms

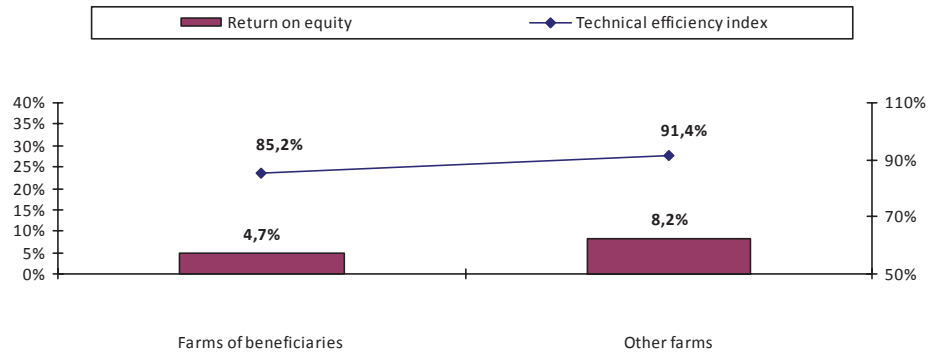
On a basis of the figures from Chart 3, it can be concluded that investing free funds in the activity of the farms was less profitable for the owners of the farms of beneficiaries. In these farms, the return on equity was, in fact, 4.7%, while in other farms – 8.2%. It must be stressed, however, that in both cases, the return on equity was higher than the interest rate on treasury bonds (on average, 3.1% in the years 2006-2014)[31].

Moreover, the figures in Chart 3 indicate that the farms of beneficiaries against a background of other farms in a less technically efficient manner used

[30] Applies to the type of farming: dairy cows (5) and other animals fed on roughage (6).
[31] The analysis assumed the average net interest rate of 24-month treasury bonds with annual capitalised interest in the years 2006-2014 [www.obligacje skarbowe.pl].

their inputs to obtain the potential production value. In those farms, the technical efficiency index was, in fact, 85.2%, and in other farms – 91.4%.

Chart 3. Return on equity and technical efficiency index in the analysed farms of beneficiaries and in other farms in the years 2006-2014



Source: as in Map 1.

The level of the return on equity and technical efficiency index is largely determined by the state of equipping a farm with production factors. One of them is the UAA. In the farms of beneficiaries, the UAA was smaller and amounted to 33.2 ha, while in other farms it was 43.1 ha. Of lower importance for the activity of the farms of beneficiaries was also rented land. Those farms had 19.5% of this land while other farms had 32.6% (Table 4). However, it must be stressed that the average UAA in the analysed farms of beneficiaries was much bigger than the average UAA of the farms of all beneficiaries of the afforestation measure under the RDP 2004-2006. According to the data of the Agency for Restructuring and Modernisation of Agriculture (ARMA), it was 12.6 ha of UAA.

Between the analysed groups of the farms, a difference has been observed in the own soil valuation index. Disadvantaged in this respect were the farms of beneficiaries, in which this index was, on average, 0.7 and was by 22.2% lower than the soil valuation index of other farms. This ratio was confirmed by the share of own UAA with V and VI soil valuation class in the UAA. In the farms of beneficiaries, its share in the total UAA was, in fact, 24.3%, while in other farms – 13.8% (Table 4).

The production potential of the farm is also determined by incurred labour inputs and own capital resources. In the case of labour inputs per 1 ha of UAA, they were greater in the farms of beneficiaries (Table 4). In those farms, they

were, in fact, 120.0 hours, and in other farms – 107.0 hours per 1 ha of UAA. In the farms of beneficiaries, the share of paid employment in total labour inputs was also higher by 1.7 p.p. Those farms, when compared to other farms had, however, the average capital value lower by 35.3%.

Table 4. Production potential of the analysed farms of beneficiaries and other farms in the years 2006-2014

Variable	Measure unit	Farms:	
		of beneficiaries	other
Utilised agricultural area, including: - rented land	ha %	33.2 19.5	43.1 32.6
Own soil valuation index	pts	0.7	0.9
Share of own UAA of V and VI soil valuation class in the total UAA	%	24.3	13.8
Total labour inputs per 1 ha of UAA, including: - paid employment	hour %	120.0 14.9	107.0 13.2
Average capital value	thousand PLN	477.9	738.3

Source: as in Map 1.

The analysis of production organisation indicated that in the farms of beneficiaries AL had a lower share in the UAA, while in the structure of sowings the cultivation of cereals was more important (Table 5). In the farms of beneficiaries, the worse quality of owned soils resulted in the cultivation of less wheat and more oat and rye in total. In the farms of beneficiaries, the average share of wheat in sowings of cereals amounted to, in fact, 15.1%, and of oat and rye in total – 19.0%. In other farms, the share of wheat and oat and rye in sowings of cereals amounted to, respectively, 11.5% and 43.9.

In both analysed groups of the farms, the relatively large stocking density of animals per 1 ha of AL and cultivation of green manure for incorporation had a significant contribution to maintaining a positive balance of soil organic matter (Table 5), but it was not only them which were of importance. From the point of view of maintaining a positive balance of soil organic matter of importance is also the use of calcium fertilisers which reduce the soil acidity and consequently increase its capacity to accumulate organic matter. However, in the analysed period of nine years, not all farms of beneficiaries used calcium fertilisers. In those farms, the share of the farms not using calcium fertilisers in the total number of the farms was, in fact, 13.3%. Therefore, it should be assumed that in those farms, the fertilisation potential of animal manure and green manure ploughed in their fields was not fully utilised by crops. In other farms, this phenomenon did not occur.

Table 5. Production organisation in the analysed farms of beneficiaries and in other farms in the years 2006-2014

Variable	Measure unit	Farms:	
		of beneficiaries	other
Share of AL in the UAA	%	86.6	94.1
Share of cereals in AL	%	65.6	58.7
Share of wheat in sown cereals	%	15.1	43.9
Share of oat and rye in total in sown cereals	%	19.0	11.5
Share of green manure in AL	%	8.4	4.5
Stocking density of animals per 1 ha of AL	LU	0.8	1.0
Share of farms not applying calcium fertilisers[1]	%	13.3	0.0

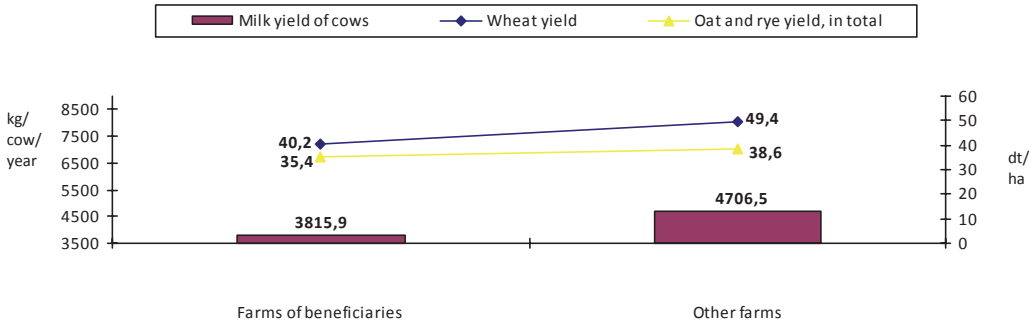
[1] *Those farms did not use calcium fertilisers in any of the analysed nine years.*

Source: as in Map 1.

As expected, the farms of beneficiaries compared to other farms had worse production results. The biggest difference to their disadvantage took place in the case of the milk yield of cows and amounted to 18.9%. It was slightly lower in the case of wheat yields – 18.6%. Definitely, the smallest difference to the disadvantage of the farms of beneficiaries took place in the case of oat and rye yields. In those farms, they were in fact smaller by 8.3% (Chart 4).

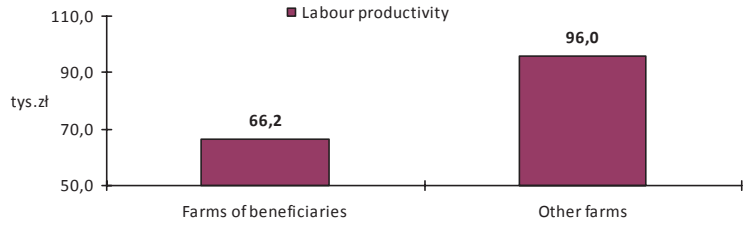
The farms of beneficiaries, when compared to other farms, had lower productivity of production factors, and one of the primary causes of this situation was their worse production results. In the farms of beneficiaries, the production value per 1 AWU was lower by 31.0%, the production value per 1 ha of UAA – by 22.9%, and the production value per PLN 1 of the average capital value – by 2.2 p.p. (Charts 5, 6 and 7).

Chart 4. Production effects of the analysed farms of beneficiaries and other farms in the years 2006-2014



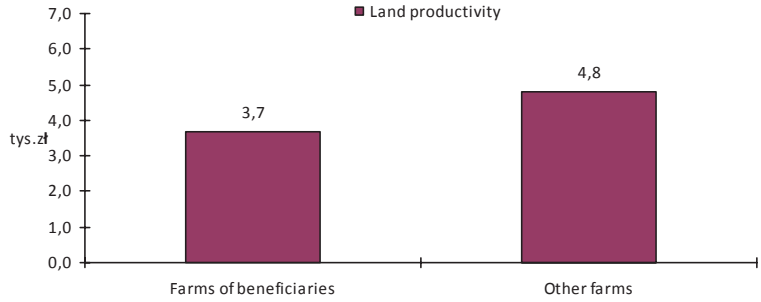
Source: as in Map 1.

Chart 5. Labour productivity (thousand PLN/AWU) in the farms of beneficiaries and other farms in the years 2006-2014



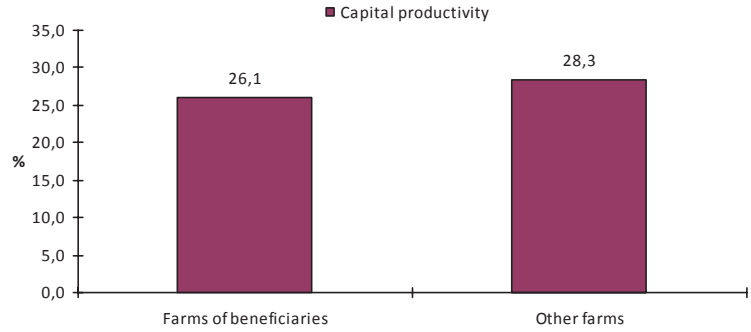
Source: as in Map 1.

Chart 6. Land productivity (thousand PLN/ha of UAA) in the farms of beneficiaries and other farms in the years 2006-2014



Source: as in Map 1.

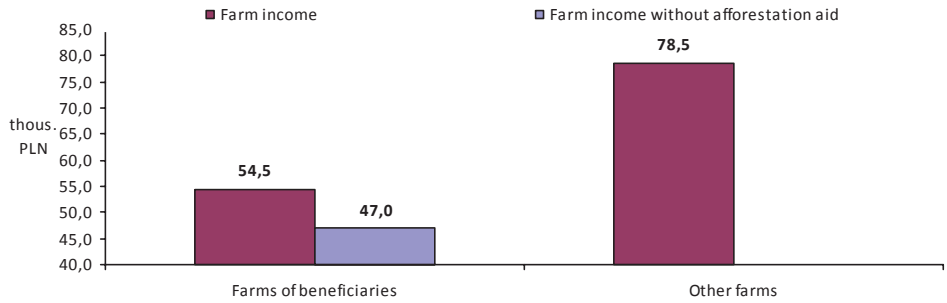
Chart 7. Capital productivity (%) in the farms of beneficiaries and other farms in the years 2006-2014



Source: as in Map 1.

Farm income also showed the differences to the disadvantage of the farms of beneficiaries. In the farms of beneficiaries, this income was lower by 30.6%, and this difference was so large that it proved statistically significant. However, in a situation of depriving the farms of beneficiaries of afforestation aid, that difference would increase to 40.1% and would also be statistically significant (Chart 8).

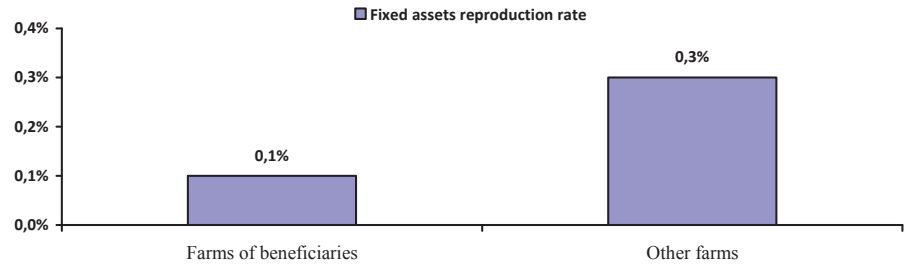
Chart 8. Farm income (thousand PLN) and farm income without afforestation aid (thousand PLN) in the farms of beneficiaries and in other farms in the years 2006-2014



Source: as in Map 1.

The greater investment activity characterised other farms, in which the fixed assets reproduction rate amounted to 0.3%. On the other hand, smaller income in the farms of beneficiaries limited their investment activity. In the case of those farms, the fixed assets reproduction rate amounted to, in fact, 0.1% (Chart 9).

Chart 9. The fixed assets reproduction rate (%) in the analysed farms of beneficiaries and in other farms in the years 2006-2014



Source: as in Map 1.

Summary and conclusions

The chapter made a comparative analysis of 15 farms of beneficiaries of the measure „Afforestation of agricultural land under the RDP 2004-2006" and 64 other farms from the same communes, which in the analysed period did not afforest land under the RDP 2004-2006, 2007-2013 and 2014-2020, and continuously kept accounts for the Polish FADN in the years 2006-2014. Account has been taken of the farms of beneficiaries and other farms from 15 communes in Poland. The comparative analysis at first considered their return on equity and technical efficiency index, and then established the following: production potential, production organisation, selected production results, productivity of basic production factors, farm income and farm income without afforestation aid and fixed assets reproduction rate.

The analysis showed that the farms of beneficiaries against a background of other farms were characterised by the lower return on equity and the lower technical efficiency index. They had the smaller UAA and the lower share of leased land. They incurred larger labour inputs per 1 ha of UAA with the higher share of paid employment and were characterised by the noticeably smaller average capital value. Owing to the worse soil conditions, they had the smaller share of wheat in the structure of sowings and the higher share of cereals with the lower soil requirements, i.e. oat and rye. They included the farms not using calcium fertilisers, what probably co-determined their worse production results on average and lower productivity of land, labour and capital. Despite receiving afforestation aid, they had definitely lower farm income and this difference was statistically significant. Those farms, being in a worse economic situation were, able to reproduce fixed assets used in the production process with interest, as informed by their positive fixed assets reproduction rate. In those farms, the scale of this phenomenon was, however, smaller than in other farms.

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COMPETITIVENESS OF THE POLISH DAIRY FARMS AND BEEF CATTLE FARMS AGAINST A BACKGROUND OF SIMILAR FARMS FROM THE SELECTED EUROPEAN UNION COUNTRIES

Introduction

The commercial agricultural production in Poland is dominated by the livestock production. In 2015, its share amounted to 58.5%. Here, an important role is played by the cattle production, which includes the production of milk and beef and veal. Its share in 2015 was 46.9%, with the share of milk amounting to 33.8% and beef and veal – 13.1% [Statistical Yearbook of Agriculture 2016]. Poland is a major producer of milk in the European Union. In 2013, it took the fourth position, with the share of 8.3%, after such countries as: Germany (24%), France (15.6%), Great Britain (9.1) [Statistisches Jarbuch über ... 2016].

The milk production is a basis of the dairy industry, whose products are largely exported. The balance of foreign trade in milk products in the past dozen years has been positive, both in quantitative and value terms. The appropriate figures are provided in Table 1. The balance of foreign trade in milk products in the years 2010-2016 in quantitative terms ranged from 1,310 thousand tonnes of raw material equivalent in 2010 to 2,404 thousand tonnes in 2015. In contrast, in value terms in that period it amounted to about EUR 890 million, ranging from EUR 701.6 million in 2016 to EUR 1,108.1 million in 2014. The share of the export of milk products in raw milk was significant and showed an upward trend from 17.8% in 2010 to 31% in 2014.

Farms rearing cattle are closely linked to land. They cultivate fodder crops, including legumes, which allows to conduct rational crop rotation management. Moreover, they have organic fertilisers in a form of manure, thus the soil is supplied with an organic substance, which fixes significant amounts of carbon dioxide. For these reasons, the production on these farms is sustainable and environment-friendly [A. Harasim, 2013]. The cattle rearing and milk production are a basis for the maintenance of a significant part of the farming population. In 2013, cattle was reared by more than 400 thousand farms, i.e. about one-third of all farms with an area of 1 ha and more.

Table 1. Foreign trade in milk products in the years 2010-2016

Specification	Years				
	2010	2012	2014	2015	2016
thousand tonnes in raw material equivalent					
Export	2,100.0	2,240.0	4,032.0	4,034.0	3,811.0
Import	790.0	900.0	1,737.0	1630.	1,793.0
Balance	1,310.0	1,020.0	2,295.0	2,404.0	2,018.0
	million EUR				
Export	1,208.1	1,717.4	1,913.8	1,650.4	1,585.1
Import	430.3	699.9	805.7	793.9	883.5
Balance	777.8	1,017.5	1,108.1	856.6	701.6
Share of the export of milk					

Source: Dairy Market No 42;47; 48 and 52, Market Analyses 2012; 2014; 2015; 2017 IAFE--NRI, Warsaw.

Given the importance of farms rearing cattle, including the milk production, for the food production (they are the first link in the food chain), in foreign trade and in land management, there is a need to examine their organisation, efficiency and processes taking place therein. In the light of the limited domestic demand for milk products, an opportunity for the development of dairy farms is the export of milk products. For this reason, the study on the efficiency of Polish dairy farms should be carried out against a background of similar farms from the selected European Union countries.

Objective and study methods

The objective of the studies was to assess the effectiveness of the functioning of Polish dairy farms (Type 45) against a background of similar farms from the selected European Union countries and to determine their ability to compete. The studies covered farms from the following countries: Poland, Hungary, Lithuania, Austria, Germany, Denmark, the Netherlands and France. The choice of the countries was deliberate. Hungary, Lithuania and Austria have been selected due to ther similar size and structure of the farms and the level of intensity of production. In contrast, Germany and France have been selected as the largest milk producers, and Denmark and the Netherlands – as the countries with the highest level of intensity of milk production. The studies covered also the dairy and beef cattle farms (Type 49). In this case, the number of the analysed countries was lower. Hungary and Lithuania were excluded, as in those countries the farms of Type 49 were not covered by the study. The detailed studies covered the farms from the above countries in the years 2013-2015. A source

of research materials was the data of the farms from the European FADN[32]. Table 2 provides the number of the analysed farms by individual economic size classes. It has been diverse, and not all classes of farms were covered by the studies. Among the Polish, Lithuanian and Austrian farms, the studies covered the dairy farms in the classes 2-5[33], Hungarian – 4-6, German – 3-6, Danish and Dutch – 5-6 and French – 3-5. In Type 49, the studies did not cover the farms in class 2 (small).

Table 2. Size of the studies dairy farms in the years 2013-2015

Countries	Economic size in SO (thousand EUR)				
	8-25 (2)	25-50 (3)	50-100 (4)	100-500 (5)	≥500 (6)
	Dairy farms (type 45)				
Poland	200-500	500 - 1000	500 - 1000	200 - 500	-
Hungary	-	-	15 - 40	15 - 40	15 - 40
Lithuania	40 – 100	40 - 100	40 - 100	40 - 100	-
Austria	40 - 100	200 - 500	200 - 500	100 - 200	-
Germany	-	40 - 100	200 - 500	100 - 200	200 – 500
Denmark	-	-	-	40 - 100	200 - 500
Netherlands	-	-	-	200 - 500	100 - 200
France	-	15 40	100 - 200	500 - 1000	
Dairy and beef cattle farms (type 49)					
Poland	-	100 - 200	40 - 100	15 - 40	-
Austria	-	40 100	15 - 40	15 - 40	-
Germany	-	100 - 200	100 - 200	200 - 500	15 - 40
Denmark	-	-	-	15-40	-
Netherlands	-	-	15 - 40	15 - 40	15 - 40
France	-	100 - 200	200 – 500	200 – 500	-

Source: European FADN.

In assessing the effectiveness of the analysed dairy farms, the indicator method has been used. The following four groups of indicators describing the: production potential, production organisation, productivity and efficiency, have been used:

I. Production potential of farms:
   1) Economic size of farms expressed in SO,
   2) Utilised agricultural area in ha,
   3) Share of rented land (%),

[32] Network of farms covered by the studies

[33] According to the economic size, the following classes have been identified: Very small (1) =<2EUR>8 thousand; small (2) =<8EUR<25 thousand; medium-small (3) =<25EUR>50 thousand; medium-large (4) =<50EUR>100 thousand; large (5) =<100EUR>500 thousand; very large (6) =EUR <500 thousand

4) Total labour input (AWU/farm),
5) Unpaid labour input (FWU/AWUx100),
6) Total assets (thousand EUR/ha),
7) Total assets (thousand EUR/AWU),
8) Share of fixed assets in total assets (%),
9) Share of net worth in liabilities (%).

II. Production organisation:
1) Share of cereals in UAA (%),
2) Share of fodder crops in UAA (%),
3) Stocking density (LU/100 ha of UAA),
4) Density of ruminant grazing livestock (LU/ha of forage area),
5) Density of dairy cows (head/farm),
6) Density of other cattle (LU/farm),
7) Share of the livestock output in the total output (%).

III. Level of costs by nature:
1) Total inputs (thousand EUR/ha),
2) Total specific costs (thousand EUR/ha),
3) Costs of purchased feed for cattle (EUR/LU),
4) Costs of own feed for cattle (EUR/LU),
5) Cost of interest paid (EUR/ha),
6) Costs of paid labour (EUR/ha),
7) Cost of lease rent paid (EUR/ha),
8) Cost of depreciation (EUR/ha).

IV. Productivity and efficiency of farms:
1)Yield of wheat (dt/ha),
2) Milk yield (kg/cow),
3) Assets productivity (output/assets - times),
4) Current assets productivity (output/current assets - times),
5) Labour productivity (output, thousand EUR/AWU),
6) Land profitability (farm income, thousand EUR/ha),
7) Assets profitability (farm income/assets - %),
8) Operator's profit (thousand EUR/farm),[34]
9) Farm income parity (%),
A1 in relation to payment for paid labour in agriculture (%),
A2 in relation to payment in the national economy (%),
10) Net investment rate (%),
11) Competitiveness index.

Table 3 shows the costs of using own production factors: land, labour and capital in the dairy farms (type 45), and Table 4 – in the beef cattle farms (Type 49). These figures are necessary to calculate the income parity[35]: A1 and

[34] Operator's profit – a difference between farm income and costs of using own production factors (labour, land and capital). The equivalent category is management income.
[35] Income parity: ratio of farm income per FWU (Family Work Unit = 2,120 hours of unpaid labour annually). It is calculated in relation to an average wage for paid labour in the given economic size class (A1) to an average wage in the national economy (A2).

A2 and the operator's profit and competitiveness index. Opportunity costs of own land have been adopted at the level of lease rent paid in the appropriate economic size classes. Costs of unpaid labour of the farmer and his family members have been adopted at two levels: a) at the level of payment for paid labour in the appropriate economic size classes of farms, as a calculation basis for the income parity A1 and b) on a basis of the average level of wages in the national economy, as a calculation basis for the income parity A2.

Table 3. Costs of own production factors: land, labour and capital in the analysed dairy farms by economic size in the years 2013-2015

Countries	Economic size in SO (thousand EUR) type 45				
	8-25 (2)	25-50 (3)	50-100 (4)	100-500 (5)	≥500 (6)
	Medium	Medium	Medium	Medium	Medium
	Costs of land (EUR/ha)				
Poland	58.0	80.9	87.1	94.2	-
Hungary	-	-	78.4	93.9	115.8
Lithuania	11.8	20.4	13.6	16.9	-
Austria	115.0	143.8	177.76	231.0	-
Germany	-	204.1	227.1	281.3	251.5
Denmark	-	-	-	499.9	616.7
Netherlands	-	-	-	704.5	930.0
France	-	68.4	109.6	151.2	-
Countries	Costs of labour in agriculture (EUR/h)				
Poland	2.04	2.24	2.25	2.70	-
Hungary	-	-	2.79	2.78	5.65
Lithuania	2.67	2.84	2.90	3.39	-
Austria	4.94	6.98	6.56	6.31	-
Germany	-	12.43	11.68	11.84	13.35
Denmark	-	-	-	21.69	22.82
Netherlands	-	-	-	13.62	16.56
France	-	7.92	11.46	12.77	-
Countries	Average wage[1] (EUR/h)		Costs of capital according to 10-year bonds (%)[2]		
Poland	4.29		4.7		
Hungary	3.59		6.6		
Lithuania	3.11		5.4		
Germany	15.67		1.9		
Denmark	25.52		2.1		
Netherlands	16.0		2.2		
Austria	14.02		2.4		
France	14.94		2.5		

[1] Median of wages, all employees (apart from trainees).
[2] Calculations based on daily data from national central banks.
Source:Eurostat(http://appso.eurostat.ec.europa.eu/nui/show.do?dataset=earn_ses_pub2s&lang=en; access on 29.05.2017), European FADN.

Table 4. Costs of using own production factors in the analysed beef cattle farms (Type 49) in the years 2013-2015

Countries	Economic size in SO (thousand EUR) type 49			
	25-50	50-100	100-500	≥500
	Medium	Medium	Medium	Medium
	Costs of land (EUR/ha)			
Poland	80.9	87.1	94.2	-
Austria	143.8	177.76	231.0	-
Germany	204.1	227.1	281.3	251.5
Netherlands	-	-	704.5	930.0
France	68.4	109.6	151.2	-
Countries	Costs of labour in agriculture (EUR/h)			
Poland	2.24	2.25	2.70	-
Austria	6.98	6.56	6.31	-
Germany	12.43	11.68	11.84	13.35
Netherlands	-	-	13.62	16.56
France	7.92	11.46	12.77	-

Source: European FADN.

The competitiveness of the farms has been defined using the competitiveness index (Wk) according to W. Kleinhanss[36]. The competitiveness index (times) has been determined as a quotient of farm income and the total of estimated costs of using own production factors: labour, land and capital (Equation 1). The value of the competitiveness index Wk>=1 indicates that farm income fully covers costs of production factors, while Wk<1 indicates that coverage of these costs by income is incomplete. Following Kleinhanss, the further classification of Wk has been adopted by identifying the following classes: Wk (-) – in the case of negative Dzgr (Wk1), 0<Wk<1 – partial coverage of own costs of production factors (Wk2), 1=Wk<2 – full coverage of costs of production factors (Wk3), Wk>=2 – double and more coverage of costs of production factors (Wk4). The competitiveness index Wk3 points to the competitive capacity, while Wk4 points to the full competitiveness of the farm.

This conclusion is consistent with the Binswanger's view who states that the company able to develop should achieve the profit rate twice as high as the credit interest rate[37].

[36] Kleinhanss W., *Competitiveness of major types of farms in Germany*, Issues of Agricultural Economics, No 1/2015.
[37] Binswanger H.Ch., *The growth spiral - money, energy, and imagination in the dynamics of the market process*, ZYSK I S-KA, Poznań 2011.

$$Wk = \frac{Dzgr}{Kwz+Kwp+Kwk} \quad (1)$$

where:

WK – competitiveness index,
Dzgr – farm income,
Kwz – opportunity cost of own land,
KWP – opportunity cost of unpaid labour,
KwK – opportunity cost of net worth (without own land).

In this paper, the competitiveness has been defined as the farm's ability to develop. The farm obtains this ability when farm income covers costs of own production factors. This approach is different from traditional defining of the competitiveness, as obtaining advantage (cost, price, quality, etc.) in relation to competitors. The authors have previously defined the competitive capacity of the farms using the category of "operator's profit", parity-based income and net investment rate [W. Ziętara, M. Zieliński 2016].

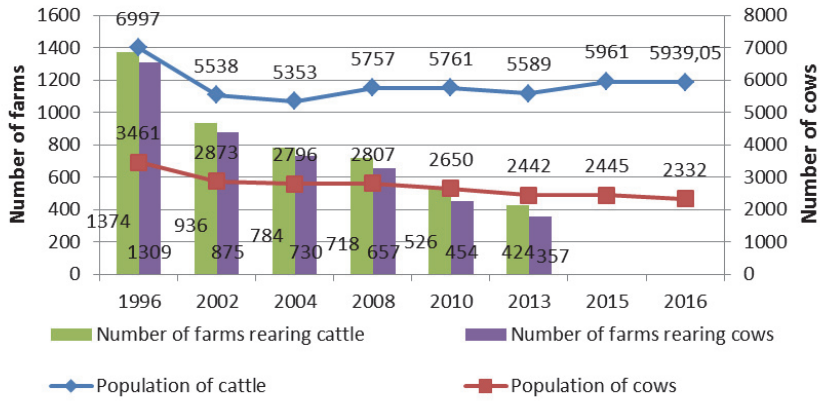
Processes of concentration of the dairy farms in Poland and in the analysed countries

Chart 1 shows the changes in the number of farms with livestock, including cows, as well as the population of cattle and cows in Poland in the years 1996-2015. The greatest changes took place in the number of farms rearing cattle and cows. In 1996, there were 1,374 thousand farms with cattle, including 1,309 thousand (95.3%) farms rearing cows, and in 2013, cattle was reared by 424,000 farms, including cows – by 357 thousand (84.2%). A decrease in the number of farms from the first group was 69% and from the other – 72.7%. The total population of cattle at that time decreased from 6,997 thousand heads in 1996 to 5,960.7 thousand heads in 2015 and 5,939 thousand in 2016. A decrease in the number of cattle was, respectively: 14.8 and 15.1%, while a decrease in the number of cows in those years was, respectively: 29.4 and 32.6%. These numbers indicate a slow growth process in the degree of specialisation of farms towards the live cattle production. In 1996, the share of such farms in the total number of farms rearing cattle was 4.7%, while in 2013 – 15.8%. The result of the different rate of decrease in the number of farms rearing cattle and cows was an increase in the average size of herds. In 1996, the average number of cattle on the farm was 5.1 heads, while of cows – only 2.4. However, in 2013 the respective numbers were: 13.2 and 6.9. In the analysed period, the average size of the cattle herd increased by 159%, while of the cow herd – by 183%.

Despite a significant increase in the degree of concentration of rearing cattle and cows in Poland, the difference in relation to the concentration of cows in

the analysed countries is very large. The appropriate figures are shown in Table 5. They relate to the years 2010-2013. The numbers provided in Table 5 show that in 2010, the average dairy farm in Poland kept 5.9 cows, while the Lithuanian farm – 4.1 cows, and the Austrian and Hungarian farms, respectively: 11.3 and 21 cows. The largest cow herds in that year were kept in Denmark and the Netherlands, respectively: 132.2 and 74.7 cows. On the other hand, in Germany and France about 45 cows were kept. In 2013, when compared to 2010, the number of cows on the farm increased in all analysed countries (from 11% in the Netherlands to 23.8% in Hungary) except for France, where it decreased by 10%. Differences among the individual countries have remained unchanged over the analysed years.

Chart 1. Number of farms rearing cattle and cows and the population of cattle and cows in the years 1996-2016.



Source: Small Statistical Yearbook 2015 (2015), GUS. Warsaw, Livestock in 2016 (2017), GUS; Ziętara W., Adamski M., Grodzki H., (2013), Polish dairy farms against a background of the selected countries, Report of the Multiannual Programme IAFE-NRI, No 86, Warsaw.

In 2010, an average cow herd in the German farms was by 7.8 times larger than in the Polish farms, while in 2013 – by 7.7 times. The respective numbers in the Danish farms in relation to the Polish farms were 22.0 and 22.4. The average size of the cow herd does not reflect the whole complexity of the phenomenon, i.e. the concentration of milk production. A more complete picture is provided by the structure of farms according to the cow rearing scale. The share of small farms (keeping herds of up to 9 cows) in Poland, Hungary and Lithuania ranged from 78 to 92%. In Austria, the share of those farms was about 50%, while in other countries it ranged from 2.4% (Denmark) to 12.9% (Germany). In Poland, the small farms kept about 30% of the population of cows, the Lithuani-

an farms – about 42%, in the Austrian – about 16%, and in the Hungarian – about 10%. In other countries, it was from 0.03% (Denmark) to 1.8% (France). Poland belongs to the leading milk producers in the European Union. With the output of 12.74 billion l of milk, it is ranked fourth after such countries as: Germany, France, Great Britain. After withdrawal of Great Britain from the EU structures, Poland is the third milk producer in the EU. There are also significant differences in the milk yield of cows. In 2013, the average annual milk yield of cows in Poland was similar to that in Lithuania and was about 5,500 l and was by 38% lower than in the Danish farms, where it was 8,900 l. In other countries, it ranged from 6,400 l (Austria) to 7,700 l (the Netherlands).

Table 5. Number of dairy farms, population of cows and milk output in the analysed countries in the years

Countries	Years	Number of dairy farms, thousand	Number of cows, thousand	Size of the cow herd/farm	Share of small farms[a] (%)	Share of cows in small farms (%)	Milk output, million l	Average milk yield, l/cow
Poland	2010	452.8	2,505.6	5.9	82.5	32.2	12.43	4,854.0
	2013	334.5	2,343.51	7.0	77.7	26.8	12.74	5,532.0
Hungary	2010	11.4	239.0	21.0	81.5	10.6	1.68	7,050.0
	2013	9.5	250.0	26.0	78.0	9.4	1.78	7,091.0
Lithuania	2010	85.0	352.6	4.1	85.7	44.9	1.73	4,815.0
	2013	65.0	318.1	4.9	91.8	40.8	1.72	5,447.0
Austria	2010	47.7	540.	11.3	54.1	19.6	3.25	6,115.0
	2013	42.2	536.0	12.7	49.3	15.4	3.42	6,407.0
Germany	2010	89.8	4,164.8	46.4	12.9	1.4	29.63	7,085.0
	2013	78.8	4,251.4	54.0	12.4	1.2	31.34	7,343.0
Denmark	2010	4.3	568.2	132.2	4.6	0.1	4.91	8,569.0
	2013	3.	582.3	157.4	2.7	0.03	5.09	8,963.0
the Netherlands	2010	19.8	1,487.6	74.7	3.8	0.1	11.95	7,866.0
	2013	18.7	1,552.9	83.0	3.7	0.02	12.64	7,769.0
France	2010	82.6	3,720.0	45.0	10.2	0.7	23.93	6,464.0
	2013	92.5	3,737.2	40.4	12.6	1.8	26.65	6,607.0

a – small farms keeping up to 9 dairy cows

Source: Statistisches Jahrbuch über Ernährung, Landwirtschaft und Forsten, 2015, Landwirtschafts Verlag, Münster.

Competitiveness of the Polish dairy farms against a background of the analysed countries

The competitive capacity of the analysed dairy farms have been determined using the competitiveness index Wk, calculated as a ratio of farm income to the costs of using own production factors (labour, land and capital). The figures describing the competitive capacity of the analysed dairy farms are shown in Table 6.

Table 6. Competitive capacity of the Polish dairy farms against a background of the EU farms (average of the years 2013-2015)

SO, thousand EUR	Poland	Hungary	Lithuania	Austria	Germany	Denmark	the Nether-lands	France
Competitiveness index Wk (times)								
(2) 8-25	0.53	-	0.66	0.26	-	-	-	-
(3) 25-50	0.89	-	0.94	0.47	0.45	-	-	0.40
(4) 50-100	1.35	1.90	1.87	0.70	0.64	-	-	0.41
(5) 100-500	1.78	2.90	2.24	0.87	0.90	0.42	0.70	0.63
(6) ≥500	-	1.28		-	1.11	0.34	0.92	-
Operator's profit (thousand EUR/farm)								
(2) 8-25	-5.0	-	-2.9	-13.2	-	-	-	-
(3) 25-50	-1.8	-	-0.6	-17.3	-19.5	-	-	-17.0
(4) 50-100	7.7	17.0	11.0	-12.2	-14.9	-	-	-24.7
(5) 100-500	30.1	68.8	29.4	-7.1	-5.5	-54.3	-23.5	-23.8
(6) ≥500	-	55.3	-	-	11.1	-124.2	-13.8	-
Net investment rate (%)								
(2) 8-25	-61.4	-	-	9.4	-	-	-	-
(3) 25-50	-17.5	-	8.2	20.2	-29.4	-	-	-29.1
(4) 50-100	18.6	79.2	19.2	50.5	15.3	-	-	-13.4
(5) 100-500	83.1	170.6	59.0	46.3	32.3	-40.8	105.3	-3.1
(6) ≥500	-	32.1	52.9	-	74.5	40.9	181.8	-
Income parity A1 (%)								
(2) 8-25	77.5	-	68.1	36.8	-	-	-	
(3) 25-50	155.9	-	121.5	65.5	55.2	-	-	40.0
(4) 50-100	311.2	402.3	305.3	110.4	82.0	-	-	42.8
(5) 100-500	534.2	1,177.2	681.0	160.4	131.0	75.9	125.8	74.0
(6) ≥500	-	-		-	259.3	101.4	225.2	
Income parity A2 (%)								
(2) 8-25	36.9	-	58.3	13.0	-	-	-	-
(3) 25-50	81.3	-	110.9	32.6	43.8	-	-	21.2
(4) 50-100	163.0	312.3	284.6	51.7	61.1	-	-	32.8
(5) 100-500	336.4	910.5	742.8	72.2	98.9	64.5	106.4	63.2
(6) ≥500	-	-	-	-	220.9	90.7	231.6	-

Source: European and Polish FADN.

From the figures provided in Table 6 it results that most of the analysed dairy farms do not have the competitive capacity. This applies to all small and medium-small farms, medium-large farms from Austria, Germany and France, large farms from Austria, Germany, Denmark, the Netherlands and France, and very large farms from Denmark and the Netherlands. The competitive capacity in the medium-large farms is shown by the Polish, Hungarian and Lithuanian farms, where the value of the Wk index is, respectively: 1.35; 1.90 and 1.87, in the large farms only the Polish farms with the Wk value 1.78 and in the very large farms – Hungarian and German farms, where the value of the Wk index was, respectively: 1.28 and 1.11. Fully competitive proved to be only the large Hungarian and Lithuanian farms, where the value of the Wk index was, respectively: 2.9 and 2.24. The operator's profit in all farms, where the value of the Wk index was lower than 1, was negative. Its value varied and depended not only on farm income but, above all, on the level of costs of using own production

factors. In the small and medium-small farms, the net investment rate was either negative or very low. The net investment rate in all French farms and in the large Danish farms was negative. The income parity A1, determined as the ratio of farm income per 1 FWU to the average level of payment of paid labour in the given economic size class of the farms should be more than 100%. This desired value has been reached only by the medium-small Polish and Lithuanian farms and medium-large Polish, Hungarian, Lithuanian and Austrian farms.

As regards the class of large farms, the desired values have not been achieved only by the Danish and French farms. In the case of the very large farms, the desired values have been achieved by all farms. The desired A2 income parity level, determined as the ratio of farm income/FWU to the average wage in the national economy, has been achieved only by the medium-small Lithuanian farms, medium-large Polish, Hungarian, Lithuanian and Austrian farms, large Polish, Hungarian, Lithuanian and Dutch farms and very large German and Dutch farms. When analysing both ways of assessing the competitive capacity of the farms, it must be stated that the Wk index defines it clearly and also enables its gradation. The positive net investment rate does not determine the competitive capacity of the farms. The Austrian farms, despite the fact that in all economic size classes showed the positive net investment rate, did not have the competitive capacity, since operator's profit there was negative, which means that farm income did not cover the costs of using own production factors, and did not even provide labour income at the parity level (A2). A similar situation occurred in the Danish and Dutch farms. In the latter, despite the fact that the net investment rate exceeded 100% and they had achieved income at the parity level (A2), there was no competitive capacity. The functioning of the farms without the competitive capacity is possible in a situation where users of these farms will accept the fact that the costs of using own production factors are not fully covered. These farms, however, do not have the development capacity, as the fact of lower income over a longer period of time is difficult to accept.

Characteristic of the analysed dairy farms without the competitive capacity

The figures describing the production potential and production organisation in the non-competitive dairy farms are shown in Table 7. The area of the analysed farms was diverse. The medium-small Polish farms used 12.5 ha of UAA, twice less than the Lithuanian farms and by 18% less than the Austrian farms. The medium-large farms used 22.5 ha of UAA, three times less than the Lithuanian farms, and similarly as the Austrian farms. The larger area in each economic size class was characteristic of the French farms. The largest UAA was held by the large and very large Danish farms, respectively: 84.5 and 112 ha of UAA. The value of assets per 1 ha of UAA was also highly diverse.

Table 7. Production potential and production organisation in the dairy farms unable to compete, in the years

SO, thousand EUR	Poland	Hungary	Lithuania	Austria	Germany	Denmark	the Netherlands	France
Competitiveness index (Wk2)								
(2) 8-25	0.53	-	0.66	0.26	-	-	-	-
(3) 25-50	0.89	-	0.94	0.47	0.45	-	-	0.40
(4) 50-100	-	-	-	0.70	0.64-	-	-	0.41
(5) 100-500	-	-	-	0.87	0.90	0.42	0.70	0.63
(6) ≥500	-	-	-	-	-	0.43	0.92	-
Size of the farm (ha of UAA)								
(2) 8-25	12.5	-	25.5	15.3	-	-	-	-
(3) 25-50	22.5	-	60.0	22.3	19.5	-	-	37.5
(4) 50-100	-	-	-	35.7	31.1	-	-	54.2
(5) 100-500	-	-	-	58.0	74.3	84.5	47.3	104.7
(6) ≥500	-	-	-	-	-	212.9	111.9	-
Total assets (thousand EUR/ha of UAA)								
(2) 8-25	9.20	-	1.40	15.20	-	-	-	-
(3) 25-50	9.70	-	1.50	18.20	18.90	-	-	4.10
(4) 50-100	-	-	-	16.90	16.50	-	-	4.70
(5) 100-500	-	-	-	16.50	12.70	25.40	54.90	4.90
(6) ≥500	-	-	-	-	-	25.90	57.50	-
Share of fodder crops in UAA (%)								
(2) 8-25	58.10	-	83.80	97.10	-	-	-	-
(3) 25-50	60.30	-	83.90	93.50	86.50	-	-	94.50
(4) 50-100	-	-	-	90.00	81.60	-	-	89.50
(5) 100-500	-	-	-	79.80	76.80	76.20	98.10	76.00
(6) ≥500	-	-	-	-	-	75.90	94.60	-
Stocking density (LU/100 ha of UAA)								
(2) 8-25	91.90	-	37.60	37.40	-	-	-	-
(3) 25-50	114.30	-	48.30	53.40	110.10	-	-	75.90
(4) 50-100	-	-	-	61.50	134.70	-	-	96.20
(5) 100-500	-	-	-	77.50	155.30	157.00	242.30	113.80
(6) ≥500	-	-	-	-	-	170.00	271.20	-
Density of ruminant grazing livestock (LU/ha of forage area)								
(2) 8-25	1.54	-	0.43	0.63	-	-	-	-
(3) 25-50	1.85	-	0.57	0.97	1.25	-	-	0.80
(4) 50-100	-	-	-	1.40	1.63	-	-	1.07
(5) 100-500	-	-	-	1.59	1.99	1.99	2.44	1.48
(6) ≥500	-	-	-	-	-	2.15	2.80	-
Density of dairy cows (head/farm)								
(2) 8-25	7.90	-	6.50	5.50	-	-	-	-
(3) 25-50	16.90	-	18.60	11.70	13.20	-	-	19.70
(4) 50-100	-	-	-	21.80	24.80	-	-	32.60
(5) 100-500	-	-	-	44.90	66.10	81.80	79.10	65.30
(6) ≥500	-	-	-	-	-	226.90	210.00	-

Source: as in Table 6.

The lowest value of assets was observed in the case of the Lithuanian farms, it was, on average, EUR 1.45 thousand/ha of UAA. Relatively low was also the value of assets in the French farms, amounting to, on average, EUR 4.5 thousand/ha regardless of the economic size class. In the Polish farms, it was EUR 9.5 thousand/ha and was about twice less than in the Austrian and German farms. By far, the highest value of assets was in the Danish and Dutch farms

where it amounted to, respectively: EUR 25 and 56 thousand/ha of UAA. The crop structure was dominated by fodder crops.

Their share ranged from 60% (Polish farms) to more than 90% (Austrian and Dutch farms). The use of the forage area referred to by the number of LU of cattle per 1 ha of this area was diversified. The lowest stocking density was in the Lithuanian farms and small Austrian farms, where it was about 0.55 LU/ha. In the Polish farms, it was about 1.7 LU and was higher than in the Austrian, French and German farms, except for the large farms. In other farms, it was 2 and more of LU/ha of forage area. The stocking density (cattle) was varied, it was lowest in the Lithuanian and Austrian farms, within the range of 40-70 LU/100 ha of UAA. In other farms, it ranged from 76 (medium-large French farms) to 170 LU/100 ha (very large Danish farms). An exception were the Dutch farms, in which the stocking density was more than 240 LU/100 ha of UAA. The size of the cow herd in the farm was also varied. The smallest cow herds were in the small farms: Polish, Lithuanian and Austrian, in which the number of cows was, respectively; 7,9, 6.5 and 5.5 cows. In the medium-small farms, it was within the range of 11.7-19.7 cows. The largest cow herds were in the very large Danish and Dutch farms, where the number of cows was, respectively, 227 and 210 cows.

Table 8 provides the figures describing the level of intensity of production determined by the total costs per 1 ha of UAA, costs of feed per LU of cattle, milk yield of cows, labour productivity, farm income, cost of using own production factors and share of payments in the farm income.

The lowest level of intensity of production was characteristic of the Lithuanian farms, in which in the class of small and medium-small farms total inputs were, respectively: EUR 515 and 708/ha of UAA. In the Polish farms, they were higher, respectively, by 87 and 65%. However, they were by about 45% lower than in the Austrian farms and by 60% lower than in the medium-small German farms. In the medium-large farms and in the large Austrian and German farms, total inputs per ha of UAA ranged from EUR 2,100 to 3,091. Definitely, the highest level of intensity of production was in the Danish and Dutch farms, where it exceeded EUR 4,600/ha. Costs of feed per 1 LU of cattle in the Polish farms were around EUR 480 and were similar as costs in the Austrian, German and French and Dutch farms. Definitely, the highest costs of feed were in the Danish farms, where in both highest classes they exceeded EUR 1,700/LU. A characteristic feature of the cost structure for feed was the high share of purchased feed. It was lowest in the Polish, Lithuanian and Danish farms, where it was within the range of 60-70%.

Table 8. Costs and production effects in the dairy farms unable to compete, in the years 2013-2015

SO, thousand EUR	Poland	Hungary	Lithuania	Austria	Germany	Denmark	the Netherlands	France
Total inputs (thousand EUR/ha of UAA)								
(2) 8-25	965.40	-	514.80	1,692.40	-	-	-	-
(3) 25-50	1,172.10	-	707.70	2,127.50	2,943.90	-	-	1,360.00
(4) 50-100	-	-	-	2,174.40	2,393.30	-	-	1,710.70
(5) 100-500	-	-	-	2,640.30	3,091.10	4,686.00	5,576.10	2,177.60
(6) ≥500	-	-	-	-	-	5,620.50	6,592.20	-
Costs of feed (EUR/SD), including the share of purchased feed (%)								
(2) 8-25	483.5/58	-	889.9/59	497.5/75	-	-	-	-
(3) 25-50	473.2/65	-	959.7/62	474.8/79	400.0/75	-	-	443.3/90
(4) 50-100	-	-	-	535.4/79	401.2/76	-	-	415.3/87
(5) 100-500	-	-	-	635.5/81	486.9/78	1,717.68	649.5/94	442.7/90
(6) ≥500	-	-	-	-	-	1,752.2/69	688.1/95	-
Milk yield of cows (kg/cow per year)								
(2) 8-25	4120	-	4851	5,041	-	-	-	-
(3) 25-50	4787	-	5283	6,033	5,501	-	-	4,820
(4) 50-100	-	-	-	6,760	6,266	-	-	5,928
(5) 100-500	-	-	-	7,457	7,465	8,292	7,901	7,051
(6) ≥500	-	-	-	-	-	8,935	8,143	-
Labour productivity (output/AWU, thousand EUR)								
(2) 8-25	8.63	-	8.63	29.73	-	-	-	-
(3) 25-50	18.61	-	23.90	34.13	39.21	-	-	35.05
(4) 50-100	-	-	-	49.43	63.29	-	-	64.21
(5) 100-500	-	-	-	84.12	135.07	246.42	179.69	108.55
(6) ≥500	-	-	-	-	-	321.58	298.23	-
Farm income (thousand EUR/farm)								
(2) 8-25	5.50	-	5.70	4.70	-	-	-	-
(3) 25-50	13.70	-	9.70	15.40	15.90	-	-	11.50
(4) 50-100	-	-	-	28.80	26.40	-	-	17.50
(5) 100-500	-	-	-	47.00	52.00	39.80	55.10	40.30
(6) ≥500	-	-	-	-	-	62.70	164.40	
Cost of own production factors (thousand EUR/farm)								
(2) 8-25	10.60	-	8.60	17.90	-	-	-	-
(3) 25-50	15.50	-	10.30	32.70	35.30	-	-	28.70
(4) 50-100	-	-	-	41.00	41.20	-	-	42.20
(5) 100-500	-	-	-	54.10	57.60	94.10	78.60	64.10
(6) ≥500	-	--	-	-	-	186.90	178.30	-
Share of payments in farm income (%)								
(2) 8-25	75.00	-	101.00	191.00	-	-	-	-
(3) 25-50	50.00	-	146.00	93.00	75.00	-	-	140.00
(4) 50-100	-	-	-	76.00	59.00	-	-	115.00
(5) 100-500	-	-	-	73.00	60.00	100.00	39.00	87.00
(6) ≥500	-	-	-	-	-	145.00	31.00	-

Source: as in Table 6.

It was highest in the Dutch farms, where it was above 94%. The milk yield of cows was also varied, it was lowest in the small and medium-small Polish, Lithuanian and French farms, where it was within the range of 4,120--5,200 kg/cow per year. It was highest in the Danish and Dutch farms, where it exceeded 8 thousand kg/cow. The labour productivity determined by the output per 1 AWU in the small and medium-small Polish farms was, respectively, EUR 8.63 and 18.61 thousand/AWU and was lower than the labour productivity of other farms in those classes. It was highest in the large and very large Danish and Dutch farms, ranging from EUR 180 to 321 thousand/AWU. Despite such the high labour productivity, those farms were not able to develop. Farm income in all farms was less than costs of using own production factors. In all analysed farms, the level of farm income was dependent on payments. Their share in income was lowest in the large and very large Dutch farms, where it was, respectively: 39 and 31% and then in medium-small Polish farms, where it was 50%. In other farms, it was by far higher. It was highest in small Austrian farms, where it was 191%.

Characteristics of the dairy farms able to compete and competitive

Table 9 shows the characteristics of the dairy farms able to compete and competitive. The following characteristics have been taken into consideration: utilised agricultural area, share of fodder crops in the utilised agricultural area, density of cattle in LU/100 ha of UAA, LU of cattle per one ha of forage area, number of cows on the farm and costs of feed per 1 LU.

From the figures presented in Table 9 it results that in the case of the medium-small farms, included in the economic size of EUR 25-50 thousand SO, none of the analysed groups of farms had the full competitive capacity. The Polish and Lithuanian farms of this class had the competitiveness index Wk (2), respectively: 0.89 and 0.94, lower than the required value 1. A similar situation took place in the large German farms and very large Dutch farms, in which competitiveness index was, respectively: 0.90 and 0.92. Given the small difference, it was decided to include those farms in the analysis. The medium-small Polish and Lithuanian farms differed in terms of the utilised agricultural area, which was, respectively, 22.5 and 60 ha of UAA. They also differed in terms of the production organisation. The share of fodder crops in UAA in the Polish farms was 60% and was by 24 p.p. lower than in the Lithuanian farms.

Table 9. Characteristics of the dairy farms able to compete and competitive in the years 2013-2015

SO, thousand EUR	Poland	Hungary	Lithuania	Germany	the Nether-lands
Competitiveness index (Wk3 and Wk4)					
(3) 25-50	0.89	-	0.94	-	-
(4) 50-100	1.35	1.90	1.87	-	-
(5) 100-500	1.78	2.90	2.24	0.90	-
(6) ≥500	-	1.28	-	1.11	0.92
Size of the farm (ha of UAA)					
(3) 25-50	22.5	-	60.00	-	-
(4) 50-100	39.30	67.00	107.60	-	-
(5) 100-500	81.30	141.60	240.80	73.40	-
(6) ≥500	-	1,235.90	-	447.70	111.90
Share of fodder crops in UAA (%)					
(3) 25-50	60.30	-	83.90	-	-
(4) 50-100	65.30	70.20	82.70	-	-
(5) 100-500	67.60	60.90	76.10	76.80	-
(6) ≥500	-	53.20	-	62.90	94.60
Density of cattle (LU/100 ha of UAA)					
(3) 25-50	114.30	-	48.30	-	-
(4) 50-100	124.90	64.00	54.10	-	-
(5) 100-500	127.50	90.10	60.50	155.30	-
(6) ≥500	-	81.20		118.00	271.20
LU of cattle/ha of forage area					
(3) 25-50	1.85	-	0.57	-	-
(4) 50-100	1.88	0.90	0.64	-	-
(5) 100-500	1.87	1.37	0.78	1.99	-
(6) ≥500	-	1.45	-	1.83	2.80
Number of cows (head/farm)					
(3) 25-50	16.90	-	18.60	-	-
(4) 50-100	31.20	26.40	35.00	-	-
(5) 100-500	64.8	82.10	88.80	66.10	-
(6) ≥500	-	627.30	-	310.30	210.00
Costs of feed (EUR/LU)					
(3) 25-50	437.20	-	961.50	-	-
(4) 50-100	506.30	957.10	1,119.00	-	-
(5) 100-500	561.70	1,080.00	1,208.00	486.90	-
(6) ≥500	-	1,382.00	-	594.20	688.10
Share of payments in farm income (%)					
(3) 25-50	50.0	-	191.0	-	
(4) 50-100	38.0	82.0	93.0	-	
(5) 100-500	30.0	67.0	76.0	100.0	-
(6) ≥500	-	286.0	-	145.0	31.0

Source: as in Table 6.

They also differed as for the level of intensity of organisation as expressed by the density of cattle in LU/100 ha of UAA. In the Polish farms, it was 114 and was more than twice higher than in the Lithuanian farms, where it was 48.3 LU/100 ha of UAA. The level of the density of cattle in the Polish farms may be rated as medium, while in the Lithuanian farms as low. Another indicator pointing to the differences in the level of intensity of organisation was the number of LU of cattle per 1 ha of forage area. In the Polish farms, there were 1.85 LU per 1 ha of that area, while in the Lithuanian farms – only 0.57. The intensity of use

of the forage area in the Polish farms was three times higher. The number of kept cows was similar and amounted to, respectively: 16.9 and 18.6 heads/farm. There were significant differences in costs of feed per 1 LU. In the Polish farms, they amounted to EUR 437, while in the Lithuanian farms – EUR 961 and were by 120% higher. The cost structure of feed was similar. In both cases, purchased feed dominated, whose share was respectively: 65 and 62%. Summing up, it can be concluded that the farms in this economic size class, although did not achieve the desired value of the competitiveness index, have some development potential.

In the economic size class of EUR 50-100 thousand SO (medium-large), the competitive capacity is shown by the Polish, Hungarian and Lithuanian farms achieving the value of the competitiveness index, respectively: 1.35; 1.90 and 1.87. Definitely, they differed as regards their area. The Polish farms were smallest. They used about 39 ha of UAA, while the Hungarian and Lithuanian farms were larger by, respectively: 70 and 174%. They also differed in terms of the share of fodder crops in UAA. In the Polish farms, that share was lowest and amounted to about 65%, while in the Hungarian and Lithuanian farms it was, respectively, 70 and 83%. The density of cattle was also different. In the Polish farms, it was about 125 LU/ 100 ha of UAA and was twice higher than in other farms. The intensity of using the forage area was also highly diverse. In the Polish farms per 1 ha of forage area, there were 1.88 LU while in the Hungarian and Lithuanian farms it was, respectively: 0.9 and 0.64 LU. The number of cows in the farms was less diverse. It was, respectively: 31; 26 and 35 heads. Costs of feed in the Polish farms were EUR 506/LU and were twice lower than in other farms, where they amounted to, respectively: EUR 957 and 1,119/LU. Costs of feed were dominated by purchased feed. Its highest share was in the Polish farms, which was 72%, while in other farms – 62%.

In the economic size class of EUR 100-500 thousand SO (large farms), the competitive capacity was shown by the Polish and German farms, by achieving the value of the competitiveness index of, respectively: 1.78 and 0.90. On the other hand, the fully competitive in this class were the Hungarian and Lithuanian farms, where the value of the competitiveness index was, respectively: 2.90 and 2.24. The area of the Polish and German farms in that class was similar and amounted to, respectively: 81 and 73 ha of UAA. The share of fodder crops in UAA was not strongly differentiated. In the Polish farms, it was about 68, while in the German farms – 77%. The density of cattle on the German farms amounted to 155 LU/100 ha of UAA and was by 22% higher than in the Polish ones. It should be rated as quite high. The intensity of use of the forage area in those farms was similar. Per 1 ha of forage area in the Polish farms, there were 1.87 LU while in the German farms – 1.99 LU. The difference in favour of the

German farms amounted to 6.4%. The number of cows in those farms was similar and in the Polish farms it was about 65, while in the German farms – 66 heads. Costs of feed per 1 LU were also similar. In the Polish farms, they amounted to EUR 563 and were by 15% higher than in the German ones. The structure of those costs was similar. The share of purchased feed was about 78%. In general, we can conclude that in this economic size class the Polish and German farms were similar in terms of production organisation and the level of its intensity.

Fully competitive in this economic size class were the Hungarian and Lithuanian farms, in which the value of the competitiveness index was, respectively: 2.90 and 2.24. They used, respectively: 141 and 245 ha of UAA. The share of fodder crops in UAA was lower than in the previously analysed farms. It was, respectively: 61 and 76%. The density of cattle in the Hungarian farms was 90 LU, while in the Lithuanian farms – 60 LU/100 ha of UAA. There was a significant difference in the use of the forage area. In the Hungarian farms, the use of that area was higher and amounted to 1.37 LU/ha, while in the Lithuanian farms – only 0.78 LU/ha and was by 43% lower. In both groups, costs of feed were high. They amounted to, respectively: EUR 1,080 and 1,208/LU. The share of purchased feed was similar and was 64 and 67%.

In the class of the very large farms, the competitive capacity was demonstrated by the Hungarian, German and Dutch farms, where the competitiveness index was respectively, 1.28; 1.11 and 0.92. Those farms were definitely different in terms of their area, which was the largest in the Hungarian farms. It was 1,236 ha and was by 2.8 times larger than in the German farms and 11 times larger than in the Dutch farms. The share of fodder in the Hungarian and German farms was low. It was, respectively: 53 and 63%. Definitely, it was higher in the Dutch farms, where it was about 95%. The density of cattle was also highly diverse. It was lowest in the Hungarian farms, where it was 81 LU/ 100 ha, in the German farms, where it was 118 SD, and definitely highest in the Dutch farms, where it was as many as 271 SD/100 ha of UAA. The intensity of use of the forage area was also highly diversified. It was lowest in the Hungarian farms, in which per 1 ha of forage area there were 1.45 LU, in the German farms – 1.83 LU, in the Dutch farms – 2.80 LU/ha. The number of kept cows was also varied. In the Hungarian farms, it was 627 heads, while in the German and Dutch farms: 310 and 210 heads, respectively. Costs of feed in the Hungarian farms amounted to EUR 1,382/LU and were more than twice higher than in the German and Dutch farms. Costs of feed were dominated by purchased feed, whose share in the Dutch farms amounted to 95%, while in the German farms – 83%, and in the Hungarian farms – 74%. Farm income was dependent on received payment. Their share in income was diverse. It was lowest in the Polish

farms, ranging from 50 to 30% and showing a downward trend with increasing the economic size of the farms. The highest share took place in the very large Hungarian and German farms, where it was, respectively: 286% and 145%.

Role of the farms rearing dairy cows by economic size and competitive capacity in Poland

The question about the role of the dairy farms able to compete in the milk production becomes reasonable. In the previous chapters, it was determined that among the analysed dairy farms, the farms able to compete proved to be the farms with the economic size amounting to 25 and more thousand SO. Based on the available data provided in Table 10, it has been calculated that in 2013, the number of such farms rearing cows was 98,481 thousand, and their share in the total number of farms rearing cows was 27.6%. This group also includes the farms with the economic size of 25-50 thousand SO where the competitiveness index was 0.89. It was considered that that group of the farms also is able to compete. The farms able to compete kept 1,817,260 cows, and their share in the total number of cows was 72.60%. By far, the greater was the share of this group of the dairy farms in the global milk production, which in that year was about 91%, including in the classes above EUR 50 thousand SO – 61%.

Table 10. Structure of the farms rearing cows by economic size and competitive capacity in Poland in 2013.

Specification	Economic size of the farms (thousand EUR SO)						
	Total	up to 8	8-25	25-50	50-100	100-500	>=500
Number of farms with cows	356,817	119,994	138,342	62,532	28,435	6,950	564
Structure (%)	100.00	33.64	38.78	17.53	7.94	1.95	0.16
Number of cows (heads)	2,503,950	164,250	522,440	716,280	651,110	306,920	142,950
Structure	100.00	6.55	20.87	28.61	26.00	12.26	5.71
Average number of cows per farm	7.01	1.36	3.78	11.45	22.88	44.16	253.45
Number and share of non- and competitive farms		258,336 (72.4%) -		- 98,481 (27.60%)			
Number and share of cows in non- and competitive farms.		686,690 (27.4%) -		- 1,817,260 (72.60%)			

Source: Own calculations based on: Characteristics of farms in 2013. GUS 2014.

The average size of the cow herd in those farms amounted to 18.5 heads, while in the class above EUR 50 thousand SO – 30.6. On this basis, it can be concluded that a basis for the milk production were the farms able to compete. It can be assumed with a high level of probability, that the process of concentra-

tion in the milk production will take place in the following years. The number of and share of the farms of up to EUR 25 thousand SO, as well as of the class of EUR 25-50 thousand SO will decrease, while the number of the farms with the economic size of EUR 50 thousand SO and more, which are able to compete, will increase.

Polish beef cattle farms against a background of the farms from the selected countries and production potential of the analysed beef cattle farms

Monitoring of the European FADN covered, in addition to the Polish beef cattle farms, also similar farms from Austria, Germany, the Netherlands and France. In addition, the farms of this type (49) do not represent all economic size classes. The class of the medium farms of EUR 25-50 thousand SO, includes, in addition to the Polish farms, also the Austrian and German farms. In the class of the medium-large farms with the value of EUR 50-100 thousand SO, there are also the French farms. In the class of the large farms with the value of EUR 100-500 thousand SO, there are the German, Dutch and French farms. On the other hand, in the class of the vary large farms with the value of EUR 500 thousand SO and more, there are only the German and Dutch farms. The figures describing the production potential of the analysed farms are provided in Table 11. The UAA of the analysed medium-small Polish, Austrian, German and French farms was diverse, ranging from 30.3 (Poland) to 67.4 (France) ha of UAA. In the next class of EUR 50-100 thousand SO, the diversification of the area of the farms was also significant. Their area ranged from 50.1 (Germany) to 98.1 (France) ha of UAA. In the class of the large farms, the largest area was that of the French farms (153.1 ha), and smallest – of the Dutch farms (37.4 ha). In the class of the very large farms, there were only German and Dutch farms, which used, respectively: 417.4 and 41.4 ha of UAA.

In addition to own land, the analysed farms also used rented land. The share of rented land increased as the economic size of the farms increased. The lowest share of rented land was in the Austrian farms, where it was, respectively: 13.2 and 16.9%, while highest – in the large French farms, where it amounted to 65.7%. In the medium-small and medium-large Polish farms, the share of rented land was, respectively: 21.2 and 25.6%. In the German and Dutch farms, it was within the range of 42-54%. Total labour input in all classes, except for the very large German and Dutch farms, was within the range of 1.1-2.2 AWU/farm. In the very large German farms, it was 5.6 AWU. Labour input was dominated by unpaid labour, except for the very large German farms, where unpaid labour input was 21.2%. Unpaid labour input decreased as the economic

size of the farms increased. The total assets in the Polish, Austrian and German farms ranged from EUR 6 to 15 thousand/ha of UAA.

Table 11. Production factors in the Polish beef cattle farms against a background of the EU farms (the average of the years 2013-2015)

SO, thousand EUR	Poland	Austria	Germany	the Neth-erlands	France
Economic size of the farms (SO)					
(3) 25-50	34.9	36.2	36.2	-	39.4
(4) 50-100	70.0	68.1	73.6	-	75.1
(5) 100-500	-	-	213.1	298.9	179.9
(6) ≥500	-	-	899.0	740.7	-
Utilised agricultural area (ha of UAA)					
(3) 25-50	30.3	35.9	38.3	-	67.4
(4) 50-100	55.6	78.4	50.1	-	98.7
(5) 100-500	-	-	89.1	37.4	153.1
(6) ≥500	-	-	417.4	41.4	-
Share of rented land (%)					
(3) 25-50	21.2	13.2	44.0	-	43.7
(4) 50-100	25.6	16.9	44.8	-	56.9
(5) 100-500	-	-	49.2	41.8	65.7
(6) ≥500	-	-	54.4	46.1	-
Total labour input (AWU/farm)					
(3) 25-50	1.7	1.6	1.1	-	1.7
(4) 50-100	2.0	1.8	1.2	-	1.8
(5) 100-500	-	-	1.7	1.4	2.2
(6) ≥500	-	-	5.6	2.2	-
Unpaid labour input (%)					
(3) 25-50	73.4	71.9	73.3	-	74.4
(4) 50-100	71.2	72.2	71.3	-	72.8
(5) 100-500	-	-	61.1	66.5	66.7
(6) ≥500	-	-	21.2	58.5	-
Total assets (thousand EUR/ha of UAA)					
(3) 25-50	8.28	14.94	10.13	-	3.63
(4) 50-100	7.53	8.13	10.44	-	3.78
(5) 100-500	-	-	10.74	40.21	4.07
(6) ≥500	-	-	6.02	55.92	-
Share of fixed assets in total assets (%)					
(3) 25-50	87.54	82.55	91.38	-	71.36
(4) 50-100	87.32	80.73	89.37	-	69.41
(5) 100-500	-	-	84.28	80.40	65.60
(6) ≥500	-	-	76.23	84.03	-
Share of net worth in liabilities (%)					
(3) 25-50	94.98	86.10	90.12	-	78.96
(4) 50-100	88.97	91.81	85.67	-	71.44
(5) 100-500	-	-	80.09	60.76	61.32
(6) ≥500	-	-	66.45	49.30	-

Source: as in Table 6.

The lowest value of assets was in the French farms, where it was about EUR 4 thousand/ha, while it was definitely highest in the large and very large Dutch farms where it was, respectively: EUR 40 and 56 thousand/ha of UAA. Assets were dominated by fixed assets. In all farms, except for the French farms, their share exceeded 80%, while in the French farms it was about 70%. Liabilities were dominated by the share of net worth, whose share decreased as the economic size of the farms increased.

Production organisation in the beef cattle farms

Production organisation in the analysed farms has been characterised by the following indicators: share of cereals in UAA, share of fodder crops in UAA, density of cattle in total and without dairy cows in LU/100 ha, density of cattle in LU/ha of forage area and share of the livestock production in the total production. The appropriate figures are shown in Table 12. Crop production organisation in the analysed farms has been focused on the needs of the livestock production. It was characterised by the low share of cereals, with the simulatenous high share of fodder crops in UAA. The share of cereals was highest in the Polish and German farms, where it did not exceed 30%. The share of fodder crops in the Polish farms was lowest and in the medium-small and medium-large farms it was, respectively: 67 and 69%. On the other hand, in other farms it exceeded 90%. An exception were the large and very large farms, where the share of fodder crops was, respectively: 77 and 70%. The density of cattle in total in the medium-small and medium farms was about 90 LU/100 ha of UAA. It was lower in medium-small and medium-large Austrian farms, where it was, respectively: 76 and 55 LU/100 ha of UAA. It should be rated as relatively low. The farms geared towards the beef and veal production also kept, to a small extent, dairy cows. In the Polish and Austrian farms, this share was higher, within the range of 14-20%. On the other hand, in the German and French farms in this economic size class it was within the range of 1-8%. In the large and very large farms, the density of cattle was strongly differentiated.

In the German and French farms, it ranged from 116 to 141 LU/100 ha of UAA. It may be rated as average. The share of dairy cows was ranged from 12 (France) to 22% (Germany). The density of cattle was definitely higher in the large and very large Dutch farms where it was, respectively: 489 and 1,136 LU/100 ha, with the very low share of dairy cows, of about 4%. The use of the forage area specified by the number of LU of cattle/ha was varied. It was lowest in the Austrian farms, amounting to 0.81 LU/ha in the medium-small farms and 0.62 LU/ha in the medium-large farms. It was also low in the medium-small German and French farms, where it was, respectively: 0.86 and 0.90 LU/ha of

forage area. In other farms, with the exception of the Dutch farms, per 1 ha of forage area they were from 1.13 (France) to 1.83 (Germany) LU/ha. In the large and very large Dutch farms, per 1 ha of forage area they were, respectively, 6 and 13 LU. These figures show that in those farms, rearing of beef cattle was based on purchased feed. So far, it has been claimed that cattle rearing is closely linked with land, due to roughage, which should be produced on the farm [R. Manteuffel 1984]. The example of the Dutch farms indicates that cattle rearing, similarly as poultry and swine rearing may be conducted with the small share of land. This is a significant symptom indicating the increased marketability of the roughage production. The analysed farms with the beef and veal production were specialised in that type of production. This is evidenced by the share of the livestock (cattle) production in the total production, which exceeded 70%. An exception were the medium-small and medium-large Austrian and German farms, where that share did not exceed 65%.

Table 12. Production organisation in the Polish beef cattle farms against a background of the EU farms (the average from the years 2013-2015)

SO, thousand EUR	Poland	Austria	Germany	the Netherlands	France
Share of cereals in UAA (%)					
(3) 25-50	29.3	5.4	8.7	-	4.1
(4) 50-100	26.3	8.5	16.3	-	7.6
(5) 100-500	-	-	20.3	6.0	13.1
(6) ≥500	-	-	24.2	2.0	-
Share of fodder crops (%)					
(3) 25-50	67.1	93.9	90.5	-	95.5
(4) 50-100	68.6	89.2	82.1	-	92.1
(5) 100-500	-	-	76.9	92.7	85.8
(6) ≥500	-	-	69.9	91.8	-
Total density of cattle/including without dairy cows (SD/100 ha)					
(3) 25-50	90.2/77.7	76.4/64.5	78.0/76.5	-	85.7/85.0
(4) 50-100	93.5/74.5	55.5/44.6	96.7/88.7	-	103.8/99.5
(5) 100-500	-	-	140.7/118.2	498.5/478.6	127.5/112.2
(6) ≥500	-	-	115.1/89.1	1,136.2/1,084.4	-
Density of ruminant grazing livestock (per 1 ha of forage area)					
(3) 25-50	1.35	0.81	0.86	-	0.90
(4) 50-100	1.37	0.62	1.18	-	1.13
(5) 100-500	-	-	1.83	6.27	1.49
(6) ≥500	-	-	1.65	13.16	-
Share of the livestock production (%)					
(3) 25-50	75.8	51.5	57.1	-	89.4
(4) 50-100	76.9	64.8	64.0	-	89.0
(5) 100-500	-	-	72.5	81.5	87.1
(6) ≥500	-	-	75.0	88.8	-

Source: as in Table 6.

The level of intensity of production in the analysed beef cattle farms

The level of intensity of production in the analysed farms has been determined by total inputs and total specific costs per 1 ha of UAA. In addition, the analysis included the selected cost items. The appropriate figures are shown in Table 13. In all farms, with the exception of the Austrian farms, the level of intensity of production increases as the economic size increases.

Table 13. Level and types of costs in the Polish beef cattle farms against a background of the EU farms (the average from the years 2013-2015)

SO. thousand EUR	Poland	Austria	Germany	the Netherlands	France
Total inputs EUR/ha of UAA					
(3) 25-50	782.2	1,580.2	1,281.7	-	790.8
(4) 50-100	895.6	1,065.9	1,521.0	-	1,039.2
(5) 100-500	-	-	2,236.7	5,951.0	1,435.9
(6) ≥500	-	-	2,410.4	10,790.0	-
Total specific costs EUR/ha of UAA					
(3) 25-50	348.7	344.1	261.1	-	217.4
(4) 50-100	417.7	328.5	474.2	-	317.1
(5) 100-500	-	-	941.0	2,764.0	508.5
(6) ≥500	-	-	956.7	4,871.8	-
Feed for cattle (EUR/LU)/share of purchased feed (%)					
(3) 25-50	374.9/59	260.5/76	196.0/67	-	159.4/87
(4) 50-100	356.5/65	370.3/77	308.4/73	-	199.3/84
(5) 100-500	-	-	469.6/83	429.9/89	262.7/86
(6) ≥500	-	-	496.1/84	314.0/96	-
Costs of interest paid EUR/ha of UAA					
(3) 25-50	11.0	42.8	18.3	-	6.7
(4) 50-100	12.4	10.4	24.5	-	10.6
(5) 100-500	-	-	30.0	332.7	15.0
(6) ≥500	-	-	35.5	576.0	-
Costs of paid labour EUR/ha of UAA					
(3) 25-50	5.9	26.1	13.4	-	3.3
(4) 50-100	8.2	14.0	24.1	-	7.4
(5) 100-500	-	-	76.2	106.0	33.1
(6) ≥500	-	-	316.8	388.2	-
Costs of rent paid EUR/ha of UAA					
(3) 25-50	59.9	136.8	133.6	-	48.1
(4) 50-100	50.8	172.4	162.8	-	85.3
(5) 100-500	-	-	260.3	374.7	111.5
(6) ≥500	-	-	191.1	565.3	-
Depreciation EUR/ha of UAA					
(3) 25-50	192.4	492.6	298.9	-	177.7
(4) 50-100	207.1	294.0	283.3	-	230.0
(5) 100-500	-	-	303.0	816.6	270.0
(6) ≥500	-	-	245.2	1,759.6	-

Source: as in Table 6.

Total inputs in the medium-small Polish farms were EUR 782/ha and were similar as in the French farms. On the other hand, they were by 50 and 40% lower than in the Austrian and German farms. In the class of the medium-large farms, total inputs in the Polish farms amounted to EUR 896/ha and were

by 15% lower than in the Austrian and French farms, and also by 40% lower than in the German farms. Total inputs in the large and very large German farms were, respectively: EUR 2,237 and 2,410/ha and were by 62 and 78% lower than in the similar Dutch farms. The level and relations of total specific costs were different that those of total inputs. Total specific costs in the medium-small Polish farms were EUR 349/ha and were similar to those in the Austrian farms, while being by 34 and 60% than those in the German and French farms. In the class of the medium-large farms, total specific costs ranged from EUR 317 (France) to 474 (Germany)/ha of UAA. In the class of the large farms, total specific costs in the German farms were about EUR 950/ha and were by 66 and 80% lower than in the similar Dutch farms. In all economic size classes, the lowest total specific costs were in the French farms. There were also differences in the structure of total inputs. In the Polish farms, in the analysed classes the share of total specific costs in total inputs was about 45% and was by about 20 pp higher than in other farms. The higher share of total specific costs in the Polish farms should be rated positively.

Costs of feed per 1 LU of cattle in the medium-small Polish farms were EUR 375/LU and were by, respectively: 44, 91 and 135% higher than in the Austrian, German and French farms. In the class of the medium-large Polish farms, costs of feed were EUR 356/LU and were similar to those in the Austrian farms. In contrast, they were by 14% higher than in the German farms and by 76% higher than in the French farms. In the large and very large German and Dutch farms, costs of feed were about EUR 450/ha of UAA. They were definitely lowest in the French farms. A distinctive feature of costs of feed in all analysed farms was their structure. Costs of purchased feed were dominant. Their share in the Polish farms was lowest, about 60%, in the Austrian and German farms it was more than 70%. It was highest in the Dutch and French farms, where it was more than 80%. Costs of interest paid were varied. They ranged from EUR 6.7 (France) to 42.8 (Austria)/ha of UAA. An exception were the Dutch farms, were the costs of interest paid were, respectively: EUR 333 (large) and 576 (very large)/ha of UAA. Costs of paid labour were also varied. Low costs, not exceeding EUR 33/ha, were in all farms except for the German and Dutch farms, in which they ranged from 76 (large German farms) to 388 (very large Dutch farms)/ha of UAA. Costs of rent paid were lowest in the medium--small French farms, where they amounted to EU 48/ha, then in the Polish farms, where they were about EUR 55/ha of UAA. In the German farms, they ranged from EUR 134 (medium-small) to 260 (large)/ha. Definitely, they were highest in the Dutch farms where they amounted to, respectively: EUR 375 (large) and 565 (very large)/ha of UAA. Costs of depreciation in the Polish

farms and medium-small French farms were lowest, ranging from EUR 178 to 207/ha of UAA. In other farms, exclusive of the Dutch farms, they ranged from EUR 230 (medium-large French farms) to 493 (medium-small Austrian farms)/ha of UAA. In the Dutch farms, they were highest, respectively: EUR 817 (large) and 1,760 (very large)/ha of UAA.

Productivity and efficiency of the beef cattle farms

The productivity and efficiency of the analysed farms has been assessed using indicators describing the use of basic production factors. The appropriate figures are provided in Table 14. In the beef cattle farms, the crop production was focused on the cultivation of fodder crops. The cultivation of cereals, including wheat, was an additional activity. Information on the yield of wheat allows to conclude on the level of intensity of land use. Yields of wheat in the Polish farms were at the level of 50 dt/ha and were similar to those in the Austrian farms, medium-small German farms and French farms. Yield of wheat in other German farms were more than 70 dt/ha and in the large Dutch farms – above 80 dt/ha. The productivity of beef cattle has been determined by the value of the livestock production value per 1 LU of cattle. In the Polish farms, this value was about EUR 525/LU and was similar to that in the medium-small German farms. In the Austrian farms, the productivity of beef cattle was higher and amounted to, respectively: EUR 740 and 912/LU. In other German farms, it ranged from EUR 643 (medium-large) to 1,019 (very large)/LU. The productivity of beef cattle was at the similar level in the French farms. In the large Dutch farm, the value of the livestock production was by 20% lower than in the similar French farms. However, in the very large Dutch farms, this value was by 36% lower than in the similar German farms. The land productivity, specified by the output value per 1 ha of UAA in the medium-small and medium-large Polish farms was, respectively, EUR 0.62 and 0.70 thousand/ha and was similar to that in the medium-small German farms and medium-small and medium-large French farms. In other farms, except for the Dutch farms, the land productivity ranged from EUR 0.83 to 1.68 thousand/ha of UAA. It was substantially higher in the Dutch farms, in the large and very large farms it was, respectively: EUR 4.37 and 8.2 thousand/ha of UAA.

The assets productivity in the Polish farms was respectively: 0.07 and 0.09, and was similar to that in the Austrian, German and medium-small French farms. In other German, French and Dutch farms, it was higher, ranging from 0.11 (large Dutch farms) to 0.25 (very large German farms). The assets productivity was less diversified, ranging from 0.42 (small medium French farms) to

1.06 (very large German farms). The assets and current assets productivity increased with the growing economic size of the farms.

Table 14. Productivity and efficiency of the Polish beef cattle farms (the average from the years 2013-2015)

SO, thousand EUR	Poland	Austria	Germany	the Netherlands	France
Yield of wheat (dt/ha)					
(3) 25-50	46.6	48.9	62.3	-	53.8
(4) 50-100	54.6	63.2	70.8	-	55.2
(5) 100-500	-	-	77.1	87.9	66.9
(6) ≥500	-	-	75.5	63.8	-
Livestock production (EUR/LU)					
(3) 25-50	494	740	462	-	605.7
(4) 50-100	549	912	643	-	712.2
(5) 100-500	-	-	832	694	876.4
(6) ≥500	-	-	1,019	647	-
Land productivity (thousand EUR/ha)					
(3) 25-50	0.62	1.15	0.67	-	0.44
(4) 50-100	0.70	0.83	0.99	-	0.63
(5) 100-500	-	-	1.68	4.37	0.98
(6) ≥500	-	-	1.52	8.20	-
Assets productivity (times)					
(3) 25-50	0.07	0.08	0.07	-	0.12
(4) 50-100	0.09	0.10	0.09	-	0.17
(5) 100-500	-	-	0.16	0.11	0.24
(6) ≥500	-	-	0.25	0.15	-
Current assets productivity (times)					
(3) 25-50	0.59	0.44	0.77	-	0.42
(4) 50-100	0.70	0.51	0.89	-	0.54
(5) 100-500	-	-	0.99	0.61	0.70
(6) ≥500	-	-	1.06	0.96	-
Labour productivity (P/1AWU, thousand EUR)					
(3) 25-50	11.24	25.91	24.18	-	17.31
(4) 50-100	19.67	35.70	40.58	-	35.23
(5) 100-500	-	-	89.33	114.70	67.17
(6) ≥500	-	-	112.76	155.62	-

Source: as in Table 6

The labour productivity, determined by the output value per 1 AWU was highly diversified and increased with the growing economic size of the farms. In the medium-small and medium-large Polish farms it was, respectively: EUR 11.24 and 19.67 thousand/AWU and was twice lower than in the similar farms of the analysed countries. The highest labour productivity was achieved by the large Dutch farms (EUR 114.70 thousand) and very large German and Dutch farms, where it was, respectively: EUR 112.76 and 155.62 thousand/AWU.

Farm income, costs of using own production factors and profitability in the beef cattle farms

The figures describing farm income and costs of using own production factors are shown in Table 15. Farm income per farm in the Polish farms was, respectively, EUR 10.7 and 22.4 thousand and was comparable to that in similar other farms.

Table 15. Farm income and costs of own production factors in the beef cattle farms (the average from the years 2013-2015)

SO, thousand EUR	Poland	Austria	Germany	the Neth-erlands	France
Farm income (thousand EUR/farm)					
(3) 25-50	10.7	15.1	6.7	-	14.7
(4) 50-100	22.4	25.9	12.5	-	18.4
(5) 100-500	-	-	31.8	24.3	35.1
(6) ≥500	-	-	93.4	75.5	-
Costs of use of own land (thousand EUR/farm)					
(3) 25-50	1.3	4.3	2.3	-	2.3
(4) 50-100	2.1	10.6	3.4	-	3.4
(5) 100-500	-	-	8.5	5.8	8.5
(6) ≥500	-	-	21.1	8.6	-
Cost of unpaid labour (thousand EUR/farm)					
(3) 25-50	7.8	25.2	28.7	-	28.7
(4) 50-100	9.7	31.5	26.6	-	26.6
(5) 100-500	-	-	38.1	36.7	38.1
(6) ≥500	-	-	45.0	70.3	-
Cost of net worth (thousand EUR/farm)					
(3) 25-50	4.7	6.5	1.6	-	1.6
(4) 50-100	8.1	8.4	2.2	-	2.2
(5) 100-500	-	-	4.7	6.8	4.7
(6) ≥500	-	-	17.1	17.1	-
Total cost of own production factors (thousand EUR/farm)					
(3) 25-50	13.8	36.0	32.6	-	32.6
(4) 50-100	19.9	50.4	32.2	-	32.2
(5) 100-500	-	-	51.3	49.3	51.3
(6) ≥500	-	-	83.2	96.0	-
Share of payments in farm income (%)					
(3) 25-50	95	147	316	-	316
(4) 50-100	83	123	191	-	191
(5) 100-500	-	-	117	141	117
(6) ≥500	-	-	166	93	-

Source: as in Table 7.

An exception were the medium-small and medium-large German farms where it was, respectively: EUR 6.7 and 12.5 thousand/farm and was by 37 and 44% lower than in the Polish farms. Costs of using own land in the Polish farms were about EUR 1.5 thousand per farm and were the lowest among the analysed farms. They were highest in the medium-large Austrian farms and in the very large German farms, where they were, respectively: EUR 10.6 and 21.1 thousand/farm. Costs of unpaid labour in the Polish farms amounted to about EUR 8

thousand/farm and were the lowest among the analysed farms, where they ranged from EUR 25.2 thousand in the medium-small Austrian farms to EUR 70.3 thousand in the very large Dutch farms. The lowest cost of net worth was found in the medium-small and medium-large German and French farms, where it ranged from EUR 1.6 to 2.2 thousand/farm. In the Polish farms, the cost of net worth was EUR 4.7 and 8.1 thousand and was similar to that in other farms, except for the very large German and Dutch farms. The total cost of own production factors in the Polish farms was, respectively: EUR 13.8 and 19.9 thousand/farm and was lowest among the analysed farms, where it ranged from EUR 32.2 to 96 thousand/farm. It was highest in the very large German and Dutch farms, where it was, respectively: EUR 83.2 and 96 thousand/farm.

A distinctive feature of the beef cattle farms was the very high share of all payments in farm income. It was lowest in the Polish farms, where it amounted to, respectively: 95 and 83% and in the very large Dutch farms, where it was 93%. In other farms, it exceeded 100% and ranged from 117 to 166%. A special exception were the medium-small holding German and French farms, where it amounted to 316%.

Table 16. Profitability of the production factors, cost-effectiveness and profit margin of the beef cattle farms (an average of between 2013-2015)

SO, thousand EUR	Poland	Austria	Germany	the Netherlands	France
Land profitability (P/ha, thousand EUR)					
(3) 25-50	0.35	042	0.18	-	0.22
(4) 50-100	0.40	0.33	0.25	-	0.19
(5) 100-500	-	-	0.36	0.65	0.23
(6) ≥500	-	-	0.22	1.82	-
Assets profitability (%)					
(3) 25-50	4.27	2.83	1.73	-	5.99
(4) 50-100	5.34	4.06	2.40	-	4.94
(5) 100-500	-	-	3.32	1.62	5.64
(6) ≥500	-	-	3.72	3.62	-
Production cost-effectiveness (%)					
(3) 25-50	105.3	94.5	69.3	-	74.0
(4) 50-100	110.8	103.0	89.0	-	80.7
(5) 100-500	-	-	99.5	96.0	91.0
(6) ≥500	-	-	94.0	100.3	-
Production profit margin (%)					
(3) 25-50	56.9	36.8	26.2	-	49.6
(4) 50-100	57.6	39.9	25.4	-	29.7
(5) 100-500	-	-	21.2	14.9	23.4
(6) ≥500	-	-	14.7	22.2	-

Source: as in Table 7.

The land profitability determined by farm income per 1 ha of UAA, in the medium-small and medium-large Polish farms was, respectively: EUR 0.35 and 0.40 thousand/ha and was similar to the corresponding Austrian farms and by about 70% higher than in the German and French farms (Table 16). The highest

land profitability was in the Dutch farms where it was, respectively: EUR 0.65 and 1.82 thousand/ha of UAA. The assets profitability in the Polish farms was, respectively: 4.27 and 5.34% and was higher than in other farms, except for the French farms. Also, the cost-effectiveness and profitability of production in the Polish farms was highest among the analysed farms. The cost-effectiveness ratio there was about 108%, and the profit margin index – 57%. In other farms, the cost-effectiveness index was below 100%, except for the medium-large Austrian farms and very large Dutch farms, where it was 100.3%.

Competitiveness of the Polish beef cattle farms against a background of the analysed countries

The competitive capacity of the analysed beef cattle farms have been determined by the competitiveness index. The appropriate figures are shown in Table 17. Among the analysed farms, only two groups of the farms demonstrated the competition capacity. They were the medium-large Polish farms and very large German farms.

Table 17. Competitive capacity of the Polish beef cattle farms against a background of the EU farms (the average from the years 2013-2015)

SO, thousand EUR	Poland	Austria	Germany	the Netherlands	France
Competitiveness index Wk (times)					
(3) 25-50	0.78	0.42	0.21	-	0.46
(4) 50-100	1.12	0.51	0.39	-	0.45
(5) 100-500	-	-	0.62	0.49	0.54
(6) ≥500	-	-	1.12	0.79	-
Operator's profit (thousand EUR/farm)					
(3) 25-50	-3.0	-20.8	-25.9	-	-17.0
(4) 50-100	2.5	-24.5	-19.7	-	-22.7
(5) 100-500	-	-	-19.5	-25.0	-30.2
(6) ≥500	-	-	10.2	-20.5	-
Net investment rate (%)					
(3) 25-50	-22.0	-4.3	-29.4	-	-29.1
(4) 50-100	53.5	21.2	15.3	-	-13.4
(5) 100-500	-	-	32.3	-76.0	-3.1
(6) ≥500	-	-	74.5	-17.1	-
Income parity A1 (%)					
(3) 25-50	149.5	64.2	25.7	-	51.5
(4) 50-100	254.0	87.6	51.6	-	56.9
(5) 100-500	-	-	91.4	125.8	68.4
(6) ≥500	-	-	225.4	225.2	-
Income parity A2 (%)					
(3) 25-50	71.9	33.1	19.5	-	27.3
(4) 50-100	131.3	48.5	32.6	-	33.9
(5) 100-500	-	-	70.0	57.3	55.9
(6) ≥500	-	-	185.8	127.7	-

Source: as in Table 6.

They received the value of the competitiveness index above 1. In both types of the farms, the competitiveness index amounted to 1.12. In other farms, it ranged from 0.21 (medium-small German farms) to 0.79 (very large Dutch farms). Operator's profit in those farms was negative. The net investment rate in the medium-small farms was negative. It was also negative in all French and Dutch farms. The income parity A1 above 100% was achieved only by the Polish farms, large Dutch farms and very large German farms. On the other hand, the income parity A2 above 100% was achieved by the medium-large Polish farms and very large German and Dutch farms.

Characteristics of the beef cattle farms able to compete

The results of the previous analysis show that the competitive capacity has been shown only by the medium-large Polish farms and very large German farms. It is important to learn the characteristics of these farms. The appropriate figures are provided in Table 18. The analysed farms with the similar competitive capacity vary in terms of the production potential specified by the economic size and UAA. The Polish farms are medium-large with the value of EUR 70 thousand SO, while the German farms are very large with the value of EUR 899 thousand SO. They were 13 times bigger than the Polish farms. They also differed in terms of the area which in the Polish farms was 55 ha while in the German farms – 7.5 times larger.

Table 18. Characteristics of the beef cattle farms able to compete

Specification	Poland	Germany
Economic size of the farm (thousand EUR SO)	70.0	899
Area of the farms (ha of UAA)/share of rented land (%)	55.6/25.6	417.4/54.5
Total labour input (AWU)/Unpaid labour input	2.0/71.2	5.6/21.2
Total assets (thousand EUR/ha)/share of net worth in liabilities (%)	7.53/88.97	6.02/66.45
Share of cereals in UAA (%)/Share of fodder crops in UAA (%)	26.3/68.6	24.2/69.9
Total density of cattle/including dairy cows (LU/100 ha)	93.5/74.5	115.1/89.1
Density of cattle/ha of forage area (LU)/share of the livestock production (%)	1.37/76.9	1.65/75
Total inputs/Total specific costs (EUR/ha of UAA)	895.6/417.7	2,410.4/956.7
Costs of feed (EUR/LU)/share of purchased feed (%)	350.5/65	496.1/84
Costs of paid labour (EUR/ha)/cost of rent paid (EUR/ha)	8.2/50.8	316.8/191.1
Cost of own labour factors/including unpaid labour (thousand EUR/farm)	19.9/9.7	83.2/45
Livestock production EUR/LU/land productivity (thousand EUR/ha of UAA)	549/0.70	1,019/1.52
Assets productivity/current assets productivity (times)	0.09.0.70	0.25/1.06
Labour productivity (thousand EUR/AWU)/land productivity (thousand EUR/ha of UAA)	19.67/0.40	112.76/0.22

Source: as in Table 6.

Total labour input in the German farms was 5.6 AWU/farm and was 2.8 times higher than in the Polish farms. They also differed in terms of the share of paid labour which was 71.2% in the Polish farms and 21.2% in the German farms. The value of assets per 1 ha of UAA in the German farms amounted to EUR 6 thousand and was by about 20% lower than in the Polish farms.

The Polish farms to a lesser extent used foreign capital. Its share in liabilities amounted to 11%, while in the German farms it was about 36%. Organisation of the crop production was similar in both types of the farms. The share of cereals in UAA was, respectively, 26 and 24% and of fodder crops 69 and 70%. The total density of cattle in the Polish farms was 93.5 LU/100 of UAA, while in the German farms it was 115.1 LU and was by 23% higher. In both cases, it should be rated as average. The share of dairy cows in the density was similar. In the Polish farms it was 20%, while in the German farms – 17%. There were differences in the use of the forage area. The density of cattle in LU/ha of forage area in the Polish farms was 1.35 and was by 17% lower than in the German farms. The analysed farms definitely differed in terms of the level of intensity of production. Total inputs in the German farms were EUR 2,410/ha and were by 169% higher than in the Polish farms. The difference in total specific costs was lower and amounted to 129%. There were also differences in the cost structure. In the Polish farms, the share of total specific costs in total inputs was 47%, while in the German farms – 39%. The cost structure in the Polish farms should be rated as more favourable. Costs of feed per 1 LU in the Polish farms were EUR 350.5 and were by 29% lower than in the German farms. In the Polish farms, lower was also the share of purchased feed, which was 65%, while in the German farms it was 84%. The analysed farms differed in terms of costs of paid labour and costs of rent paid. The cost of paid labour in the Polish farms were EUR 8.2/ha while in the German farms – EUR 317/ha. Differences in the costs of rent paid were smaller. The cost of rent paid in the German farms was EUR 191/ha of UAA and was 4.8 times higher than in the Polish farms. The cost of using own production factors in the Polish farms was about EUR 20/ha and was four times lower than in the German farms. Differences in the cost of unpaid labour were larger. In the Polish farms, the cost of unpaid labour amounted to EUR 9.7/ha and was five times lower than in the German farms. The livestock productivity in the German farms specified by the value of the livestock production per 1 LU was EUR 1,019 and was about twice higher than in the Polish farms. In the German farms, the land productivity was twice higher while the labour productivity – almost six times higher. On the other hand, the land profitability was lower.

Findings and conclusions

1. In the last several years, there have been the processes of concentration in the beef cattle farms, including dairy cows, manifesting themselves in the decreased number of the farms. In the years 1996-2013, the number of the cattle farms decreased by 61%, including those rearing dairy cows – by 73%. The larger rate of the decrease in the number of the farms rearing cows resulted in the increased share of the beef cattle farms, from 4.7 to 15.8%.
2. In the analysed period, there was also a decrease in the headage of cattle by 14.8%, including a decrease in the number of cows by 29%. Also, there was an increase in the average number of cattle from 5.1 to 13.2 heads and cows from 2.4 to 6.9 heads per farm.
3. Despite the increased degree of concentration of rearing cattle and cows in the Polish farms, still there is a very large distance in relation to the Western European countries. The average size of the cow herd in Germany in the years 2010-2013 was more than seven times larger than in the Polish farms while in the Danish farms it was 22 times higher.
4. The analysis of the degree of competitiveness of the dairy farms indicated that all analysed small farms (EUR 8-25 thousand SO) and medium-small farms (EUR 25-50 thousand SO) did not have the competitive capacity. The competitiveness index was there lower than 1, ranging from 0.4 to 0.94. Their area ranged from 12.5 to 60 ha of UAA. Labour input was definitely dominated by unpaid labour input, ranging from 81 to 99.3%. Liabilities were dominated by net worth, ranging from 81.6 to 98.3%. The number of kept cows varied from 5.5 (Austrian farms) to 19.7 (French farms).
5. In the class of medium-large farms with the value of EUR 50-100 thousand SO, the Austrian, German and French farms did not have the competitive capacity. The competitiveness index in them ranged from 0.41 (French farms) to 0.70 (Austrian farms). They used from 31.1 (German farms) to 54.2 (French farms) ha of UAA. They were dominated by unpaid labour, whose share in total inputs was above 90%. Liabilities were also dominated by net worth, ranging from 68.2 (French farms) to 92.8% (German farms). The number of kept cows in the farms was from 22 to 33 cows.
6. In the class of large farms (EUR 100-500 thousand SO) and very large (more than EUR 500 thousand SO), the Austrian, German, Danish, Dutch and French farms did not have the competitive capacity. The competitiveness index ranged from 0.34 (very large Danish farms) to 0.92 (very large Dutch farms). They used the area from 31.1 (large Dutch farms) to 213 (very large Danish farms) ha of UAA. Labour input was dominated by unpaid labour,

whose share exceeded 72%, apart from the very large Danish farms where unpaid labour input was 34.8%. Those farms used foreign capital to a greater extent. This applies, in particular, to the Danish farms where the share of net worth in liabilities was, respectively: 43.46 (large) and 17.69% (very large). The number of kept cows was diversified, ranging from 45 (large Austrian farms) to 227 cows (very large Danish farms).

7. In generalising the assessment of the non-competitive dairy farms, we should note the significant differences in their production potential, specified by the area of the farms. Definitely, the larger area was that of the Lithuanian farms. The level of labour input in AWU per farm was similar in them. In terms of UAA in the individual economic size classes, the Polish farms were similar to the Austrian and German farms. A characteristic feature of the analysed non-competitive farms, particularly large and very large German, Danish and French farms was the dominant share of purchased feed, including roughage. This indicates a new trend of weakening the link between cattle rearing and the land.
8. The competitive capacity was demonstrated by the medium-large Polish, Hungarian and Lithuanian farms, large Polish farms and very large Hungarian and German farms. The limited competitive capacity was also showed by the medium-small Polish and Lithuanian farms, large German farms and very large Dutch farms. The competitiveness index in those farms was about 0.9. In the light of a small difference, those farms were also regarded as able to compete. Fully competitive proved to be the larger Hungarian and Lithuanian farms in which the competitiveness index was, respectively, 2.90 and 2.24.
9. The area of farms able to compete and competitive was highly diverse, ranging from 22.5 (medium-small Polish farms) to 1,236 (very large Hungarian farms) ha of UAA. The area of the Polish farms was definitely lower than that of the comparable Hungarian and Lithuanian farms. In the class of large farms, it was 81 ha and was similar to the area of the German farms. In the class of the very large farms, characteristic were the Dutch farms which used only 112 ha of UAA, four times less than the German farms and ten times less than the Hungarian farms.
10. The Polish farms able to compete were characterised by the lower share of fodder crops in UAA, which was within the range of 60-67%, while in the comparable farms it was about 80%, with the exception of the very large Hungarian and German farms, where it was, respectively: 53 and 63%. The density of cattle in the Polish farms was within the range of 114-127 LU/100 ha of UAA and was about two times higher than in the Hungarian and Lithuanian farms and comparable with the density in the German farms. The use

of the forage area specified as LU/ha of forage area in the Polish farms was about 1.86 LU and was more than twice higher than in the Hungarian and Lithuanian farms and similar to that in the German farms. The number of kept cows in the farms from medium-small to large was highly diversified, ranging from 17 heads (medium-small Polish farms) to 89 heads (large Lithuanian farms). It was substantially higher in the very large Hungarian, German and Dutch farms, which was respectively: 627; 310 and 210 cows.

11. Costs of feed per LU in the Polish dairy farms were about EUR 500 and were twice lower than in the comparable Hungarian and Lithuanian farms, and close to costs of feed in the German and Dutch farms. The Polish farms were less dependent on government payments. The share of payments in farm income in the Polish farms was within the range of 50-30%, showing a downward trend as the economic size was growing. Low was also the share of payments in the very large Dutch farms, which was 31%. This resulted from their smaller area. In other farms, it ranged from 67% (large Hungarian farms) to 286% (very large Hungarian farms).
12. In 2013, the number of the dairy farms with the competitive capacity was 98.5 thousand and their share in the total number of the farms rearing dairy cows was 27.6%. In those farms, there were 1,182 thousand cows and their share in the population of dairy cows was 72.6%. The share of those farms in the global milk production was 91%. It can therefore be concluded that the basis for the milk production were the dairy farms able to compete.
13. Among the analysed beef cattle farms, the competitive capacity was shown only by medium-large Polish farms with the economic size of EUR 50-100 thousand SO and the very large German farms with the economic size of EUR 500 thousand and more. The other Polish, Austrian, German and French farms did not show such capacity. The competitiveness index in those farms ranged from 0.21 (medium-small German farms) to 0.79 (very large Dutch farms).
14. The area of the beef cattle farms able to compete was highly diversified. The Polish farms used about 56 ha of UAA, while the German farms – as many as 417 ha of UAA. The area of those farms without the competitive capacity was also diversified, ranging from 30 ha (medium-small Polish farms) to 153 ha of UAA in the large French farms. The relatively small area was that of the large and very large Dutch farms, about 40 ha of UAA. The beef cattle farms were dominated by unpaid labour. An exception were the very large German farms able to compete, where unpaid labour input in total inputs amounted to 21%. Production organisation in the Polish and German farms able to compete was similar. The share of fodder crops in UAA in those

farms was: 67 and 70% and the density of cattle in LU/100 ha of UAA was, respectively, 94 and 115.

15. The productivity of the livestock production measured by the value of the livestock production per LU in the Polish farms able to compete was EUR 549 and was by 50% lower than the productivity in the German farms. In other non-competitive farms, the productivity of the livestock production ranged from EUR 462/LU (medium-small German farms) to EUR 912/LU (medium-large Austrian farms).
16. The primary source of income in the analysed beef cattle farms were various types of payments. In the Polish farms, their share in income was lowest and did not exceed 100%. In the medium-large Polish farms able to compete, it was 83%, while in other farms of the analysed countries it exceeded 100%. It was highest in the medium-small German and French farms, where it amounted to 316%. In the very large German farms able to compete, it amounted to 166%. This means that the beef cattle farms could not function without state support in a form of payments.

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GROSS MARGIN OF SELECTED AGRICULTURAL PRODUCTS IN 2016 – REGIONAL PERSPECTIVE[38]

Introduction

The Polish agriculture is largely diversified due to natural conditions, agrarian structure, workforce resources, technical measures available on farms, the level of agriculture, as well as tradition[39]. Despite relative homogeneity of political and factors market (exogenous factors), the structure, intensity and the scale of production, and consequently, income of farms in different regions of the country, are very diverse. When assessing the phenomenon from the microeconomic perspective, it means that endogenic factors have a substantial effect on the level of income, such as the production potential (i.e. resources of production factors) and its use[40].

The diversity of the use of the production potential results, to a significant extent, from the regional diversity of soil and climatic conditions. Although in recent years organisational and economic factors take on more importance, their influence particularly increased with regard to the conditions of the market economy[41].

Environmental conditions for agricultural production is also affected by the agrarian structure of farms, specific for Poland. Farms in the south-eastern Poland are mostly small in terms of area, i.e. with a surface area up to 5 ha. Thus, the use of modern technology is limited, which influences the economic side of production. The agrarian structure reflects not only the diversity of physical size of farms, but also their production potential and the possibility to generate income. Changes in the area structure of farms trigger changes in the structure of plant and animal production. The main factor determining the concentration of cultivations is the land quality. The process of concentration is a measure taken to improve the effectiveness of management. It usually leads to reduction in direct costs or introduction of a more profitable production technology.

[38] The study was prepared as part of implementation of the task entitled "The analysis of changes in the profitability of selected agricultural products", concerning the issue of "The company and the agricultural farm towards climate change and agricultural policy"; under the long-term programme entitled "Agriculture in Poland and EU 2020 +. Challenges, opportunities, threats, proposals", established by way of Resolution of the Council of Ministers for 2015-2019 and implemented in the National Research Institute of Agricultural and Food Economics.

[39] S. Krasowicz, *Produkcja zbóż w Polsce jako kryterium wykorzystania potencjału rolniczej przestrzeni produkcyjnej*, Zagadnienia Ekonomiki Rolnej, 2007, no. 2, pp. 106-116.

[40] A. Sadowski, *Regionalne zróżnicowanie opłaty pracy własnej w różnych typach gospodarstw rolnych*. Zagadnienia Ekonomiki Rolnej, 2010, no. 2, pp. 75-88.

[41] S. Krasowicz, J. Irgas, *Regionalne zróżnicowanie wykorzystania potencjału rolnictwa w Polsce*. Pamiętnik Puławski, 2003, no. 132, pp. 233-251.

Purpose of the study, source of data and methodology

The purpose of the study was to indicate major factors determining the regional diversity of production profitability of agricultural products covered by the study in 2016. The assessment also covered the level and the structure of direct costs. These costs, to a significant extent, depend on a farmer, and, at the same time, they define the intensity of production.

In conventional farms the object of studies were the results of production of winter wheat, winter rye, winter rapeseed, sweet lupin, forage peas and pork, whereas in environmental farms – the results of winter wheat and winter rye production. Empirical data describing particular agricultural products were collected in individual agricultural farms located throughout Poland. Farms were selected for the purposes of the study in a purposeful manner from a representative sample of farms, which was within the field of survey of the Polish FADN. The studies were conducted according to a methodology of the AGROKOSZTY system, as part of which data about the level of production, expenses and direct costs are collected[42].

The study results are presented using tables and graphics, a horizontal analysis was used to compare parameters describing the studied agricultural products in farms from 4 agricultural regions, i.e. Pomorze and Mazury, Wielkopolska and Śląsk, Mazowsze and Podlasie, and Małopolska and Pogórze. The average results were also presented for the entire research sample. The research covered revenues, namely the value of potentially commercial production from 1 ha of cultivation and per 100 kg of pork, as well as outlays, costs and economic effects. Our main measure for assessing the obtained results was the level of gross margin without subsidies. This category constitute a difference between the tax value of production and direct costs necessary to generate it.

The amount of current assets per production unit proves the intensity in agriculture[43]. The intensity was measured by outlays for basic current assets, the value of which is expressed in the study by the level of direct costs, and the as-

[42] Direct costs of plant production include: cost of sowing material, fertilisers from purchase, plant pesticides and growth regulators insurance of a given operation and specialised costs, i.e. directly related to a specific operation and improving the quality and the value of the final product (e.g. the cost of water irrigation, soil analysis). On the contrary, direct costs of animal production include: the cost of animals introduced to the herd as part of its replacement, the cost of fodder, rents for the use of the forage area for up to 1 year, treatment and insurance of animals and specialised costs (e.g. classification of animals, the cost of measures for maintenance and warehousing of fodder), their role similar as in the case of plant production – see A. Skarżyńska, *Koszty jednostkowe i dochody wybranych produktów w 2013 roku – wyniki badań w systemie AGROKOSZTY,* Zagadnienia Ekonomiki Rolnej, 2015, no. 2, pp. 112-132.

[43] R. Manteuffel, *Ekonomika i organizacja gospodarstwa rolniczego*. PWRiL, Warszawa 1984, pp. 163-171.

sessment covered the diversity of the intensity of production of the studied agricultural products in agricultural regions of Poland.

The gross margin without subsidies makes it possible to evaluate the economic efficiency of production of particular products, depending on fluctuations in yield, productivity per animal, changes in prices of products and prices of production measures. It also allows to correctly evaluate the competitiveness of production, as it considers the obtained value of production and incurred, strictly defined direct costs. The gross margin without subsidies may be increased by extra charges (gross margin without subsidies + extra charges = gross margin). The conducted studies consider single area payment (JPO), greening payment, additional payment, and protein crop payment.

The studied agricultural products were evaluated – regardless of the level of gross margin – using a set of indicators defining the economic efficiency of production, i.e.:

1. the share of direct costs in gross margin without subsidies,
2. the direct profitability ratio – a relation between the value of total production and direct costs expressed as a percentage,
3. direct costs per unit – direct costs incurred per production unit (1 dt),
4. the profitability of production – gross margin without subsidies per production unit (1 dt),
5. the profitability of labour inputs – gross margin without subsidies per 1 hour of labour inputs in total, i.e. own and hired labour inputs,
6. the share of subsidies in the gross margin.

Due to electronic data processing technology, there may be differences in certain calculations as a result of rounding.

Regional diversity of gross margin of selected agricultural products in 2016

Winter wheat. In Poland the winter form of wheat prevails. In 2016 its share in the structure of wheat sowings in the country was 79.5%. The share was similar for individual farms – 78.9%. In 2016 the average yield of winter wheat in individual farms was 44.9 dt/ha (as compared to 2015 when it was 2.7% higher)[44]. Their size was regionally differentiated. From calculations made on the basis of the data of the Central Statistical Office[45] (GUS) it can be concluded that in individual farms located in Wielkopolska and Śląsk the average yield of winter wheat was the highest – 49.0 dt/ha. Subsequent positions in

[44] *Plant Production in 2016. GUS,* Warsaw 2017.
[45] *Production of agricultural and horticultural products in 2016.* Central Statistical Office (GUS), Warsaw 2017.

this regard are as follows: Pomorze and Mazury – 45.2 dt/ha, Mazowsze and Podlasie – 43.7 dt/ha, and Małopolska and Pogórze – 37.9 dt/ha. According to GUS, in 2016 the average purchase price of grains of wheat in Poland amounted to PLN 62.02/dt (a 7.2% decrease as compared to 2015). Considering the regions, the largest differences between the maximum and minimum price was recorded in Wielkopolska and Śląsk (7.9%), and the smallest in Pomorze and Mazury (3.3%)[46].

In 2016 the winter wheat was covered by the studies within the AGRO-KOSZTY system. Data on the level of production, incurred expenses, and direct costs were collected in 140 individual farms located across the whole country. In order to identify factors determining the diversity of gross margin obtained from winter wheat cultivation, the results have been presented per regions, i.e. for groups of farms separated according to their location in four agricultural regions of Poland (i.e. Pomorze and Mazury, Wielkopolska and Śląsk, Mazowsze and Podlasie, and Małopolska and Pogórze). The average results for winter wheat were also presented for a research sample of farms.

The conducted studies indicated that the average yield of grains of winter wheat in Poland was 59.5 dt/ha and exceeded by 32.5% the average yield in individual farms in the country (44.9 dt/ha). On the contrary, the selling price of grains amounted to PLN 59.02/dt and was 4.8% lower than the average price recorded for the country (PLN 62.02/dt). Winter wheat production results in groups of farms from agricultural regions were also better than the average for individual farms of the country. Yield of grains fluctuated from 56.0 dt/ha in Mazowsze and Podlasie to 66.4 dt/ha in Małopolska and Pogórze. As regards the price of grains, it was lower than the country average in every region. In Pomorze and Mazury farmers obtained the highest price – PLN 61.13/dt, and in the remaining regions the selling price of grains ranged from PLN 55.84 to PLN 59.89/dt – Table 1.

The highest revenues from winter wheat cultivation were obtained by producers in Małopolska and Pogórze (PLN 3,709/ha). It was significantly influenced by high yield of wheat, that compensated an unfavourable effect the low sale price of grains has on the level of revenues. On the contrary, the lowest revenues were recorded in Mazowsze and Podlasie (PLN 3,357/ha), for which a determining factor was the lowest – compared to other regions – yield of grains of wheat.

[46] *Procurement and prices of agricultural products in 2016.* Central Statistical Office (GUS), Warsaw 2017.

Table 1. Average production, costs and gross margin obtained in 2016 from cultivation of winter wheat in a research sample and in selected farms in agricultural regions of Poland (actual data)

Specification		Average in holdings cultivating winter wheat	Average in selected holdings in region			
			Pomorze and Mazury	Wielkopolska and Śląsk	Mazowsze and Podlasie	Małopolska and Pogórze
Number of surveyed farms		140	27	47	35	31
Utilized agriculture area	[ha]	66.70	87.34	61.43	66.58	56.83
Growing area	[ha]	21.5	27.45	21.12	19.52	19.14
Yield of grain	[dt/ha]	59.5	58.9	58.3	56.0	66.4
Selling price of wheat	[PLN/dt]	59.02	61.13	59.31	59.89	55.84
		Per 1 ha of growing area				
Total value of production	[PLN]	3514	3600	3457	3357	3709
Total direct costs	[PLN]	1391	1200	1407	1412	1578
from this: sowing materials		216	232	196	189	262
fertilizers		777	685	783	847	802
organic fertilizers		2	3	-	-	7
plant protection products		334	253	348	327	421
growing regulators		48	20	68	45	52
other		14	8	12	4	35
Gross margin without subsidies	[PLN]	2123	2399	2050	1945	2131
Total subsidies	[PLN]	869	858	871	884	848
form this: single area payment		462	462	462	462	462
payment for greening		310	310	310	310	310
additional payment		97	86	99	112	75
Gross margin	[PLN]	2992	3258	2921	2829	2978
Total labor input	[hours]	8.3	7.8	7.6	9.4	8.6
in this: own labor input		7.9	7.7	6.9	8.9	8.5
Indicators of economic efficiency						
Share of direct costs in gross margin without subsidies	[%]	65.5	50.0	68.6	72.6	74.1
Direct profitability indicator	[%]	252.6	299.9	245.7	237.7	235.0
Direct costs / 1 dt	[PLN]	23.37	20.38	24.14	25.23	23.76
Gross margin without subsidies / 1 dt	[PLN]	35.67	40.74	35.17	34.75	32.08
Gross margin without subsidies / 1 h of total labour input	[PLN]	256.7	308.83	269.01	205.87	247.16
Share of subsidies in gross margin	[%]	29.1	26.3	29.8	31.2	28.5

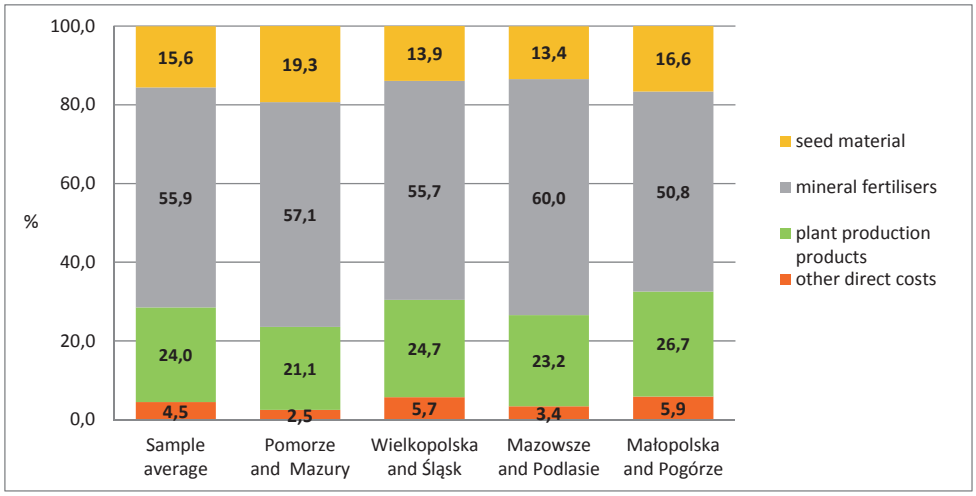
[-] – means that a given phenomenon did not occur.

Source: prepared by the author on the basis of data of the AGROKOSZTY system.

The gross margin is a result of obtained revenues and incurred direct costs. On average, in the examined group of farms direct costs per 1 ha of winter wheat amounted to PLN 1,391. The highest costs were sustained by farmers from Małopolska and Pogórze – PLN 1,578/ha, and the lowest costs by farmers from Pomorze and Mazury – PLN 1,200/ha. In each region the structure of direct costs was dominated by the costs of mineral fertilisers – from 50.8 to

60.0%. The second position in this respect was occupied by the costs of plant pesticides – from 21.1% to 26.7% – Chart 1.

Chart 1. The average structure of direct winter wheat cultivation in 2016 in the research sample and in selected farms from the agricultural regions (per 1 ha of cultivation)



Source: study based on own research.

In 2016, economic results from wheat cultivation were favourable, which is confirmed by the gross margin without subsidies, which, on average, amounted to PLN 2,123/ha in the research sample. In the regional perspective, the amount of gross margin without subsidies was determined by a specific combination of crops, prices and direct costs. However, the influence of revenue, as a derivative of production and price results, was stronger than that of incurred costs. As a result, the highest margin without subsidies was achieved by producers from Pomorze and Mazury (PLN 2,399/ha), and the lowest by farmers from Mazowsze and Podlasie (PLN 1,945/ha).

Supporting income earned from the production with subsidies results in the fact that economic surplus achieved by farmers is greater. The needs resulting from operation of the farm may, thus, covered to a greater extent. On average, in the research sample of farms, 1 ha of winter wheat cultivation entitled the farmer to receive PLN 869 of subsidy, and in agricultural regions – from PLN 848 to PLN 884 (calculations consider single area payment, greening payment and additional payment). As a result, the average gross margin with subsidies in the sample amounted to PLN 2,992/ha, and in groups of farms from agricultural regions – from PLN 2,829 to PLN 3,258/ha. To present the role of subsidy in a different way, it means that for 1 PLN gross margin without subsidies producers of wheat

in the sample group received, on average, PLN 0.41 of subsidy, and in regions from PLN 0.36 to PLN 0.45.

The economic efficiency of winter wheat cultivation was assessed by adopting the direct profitability ratio – expressed as a relation between the production value and direct costs. The average ratio for the sample was 252.6% and for the agricultural regions – from 235.0% in farms in Małopolska to 299.9% in Pomorze and Mazury.

The results of the analysis indicate that the most beneficial effects were obtained in farms in Pomorze and Mazury. This fact is proved by the lowest – as compared to other regions – direct costs per 1 dt of grains (PLN 20.38), the highest production profitability (PLN 40.74/dt) and labour inputs (PLN 308.83/h), and a relatively high cost competitiveness – share of costs in the gross margin without subsidies was the smallest – 50.0%. In the sample of farms from Mazowsze and Podlasie the economic efficiency of production of grains of wheat was the lowest. In this region direct costs per 1 dt of grains were the highest (PLN 25.23/dt), as a consequence, cultivation of wheat was not cost-competitive, and direct costs in the generated margin constituted as much as 72.6%. Moreover, the lowest profitability of labour inputs was recorded (PLN 205.87/dt). This was significantly influenced the labour intensity of wheat cultivation which was the largest in this region (9.4 h/ha).

To sum up, it should be concluded that in 2016, on average, in the sample, as well as in groups of farms classified according to their location in the agricultural regions, cultivation of winter wheat at the gross margin level was profitable. The regional variability of gross margin resulted directly from differences in the level of revenues and sustained direct costs. The highest margin without subsidies was achieved by by farmers from Pomorze and Mazury (PLN 2,399/ha). In this region the highest economic efficiency of production was also observed – it was measured using the direct profitability ratio (299.9%), as well as the highest profitability of production, which was defined by the level of margin without subsidies per 1 dt of grains (PLN 40.74). The profitability of labour inputs was also the highest (PLN 308.83/h). On the other hand, the least favourable situation were observed in the case of farmers cultivating winter wheat in Mazowsze and Podlasie, which is confirmed by the lowest value of margin without subsidies (PLN 1.945/ha), a relatively direct profitability ratio (237.7%), as well as the largest cost intensity of production (PLN 25.23/dt). It should be added that the cultivation of wheat in this region was characterised by the largest labour inputs, as a consequence, the labour profitability was also least favourable compared to other regions.

Winter rye. According to the data of GUS, in 2016 the area of cultivation of rye in Poland was ca. 761 thousand ha and constituted 10.2% of the total area of cereals cultivation in the country. The average yield of rye in individual farms in Poland was 28.4 dt/ha (5.2% higher than in 2015). An analysis of the yield of rye in the agricultural regions led to the conclusion that in Małopolska and Pogórze (32.5 dt/ha) and Wielkopolska and Śląsk (30.3 dt/ha) the yield of rye was higher than the average for individual farms, while in Pomorze and Mazury (27.8 dt/ha) and Mazowsze and Podlasie (25.2 dt/ha) – was lower than the average[47].

According to GUS, the average purchase price of grains of rye in Poland amounted to PLN 51.73/dt (0.6% higher than in 2015). Similarly to yield, the price of grains was also regionally diversified. The largest differences between the maximum and minimum price was recorded in Małopolska and Pogórze – 15.2% (i.e. PLN 6.77), and the smallest in Pomorze and Mazury – 4.3% (i.e. PLN 2.15)[48].

Research concerning the production profitability of different agricultural products, (e.g. rye, rapeseed, pork) is important for cognitive reasons, but it also has a practical dimension as it is used in agricultural consultancy. The purpose of the research, the results of which were discussed, was to demonstrate changes in the production profitability of rye (at the gross margin level). Researchers used empirical data collected from 119 individual agricultural farms, where rye was cultivated. These were units large in terms of area, located across the whole country. The average area of arable land in the research sample was 61.41 ha, and the area of cultivation of rye – 9.81 ha. To present the diversity of the production-price results and economic effects of cultivation of rye, farms from the research sample were classified according to their location in four agricultural regions of Poland – Table 2.

A point of reference for production and price results of rye in the research sample of farms were the average results for the country. It results from research that the average yield of grains of rye in the sample was 38.1 dt/ha, and its selling price amounted to PLN 48.23/dt. As compared to data of public statistics, the yield of rye was 34.2% higher than in individual farms and the selling price of grains was 6.8% lower than the average purchase price of rye in the country.

[47] *Production of agricultural and horticultural products in 2016.* Central Statistical Office (GUS), Warsaw 2017.
[48] *Procurement and prices of agricultural products in 2016.* Central Statistical Office (GUS), Warsaw 2017.

Table 2. The average production, costs and gross margin obtained in 2016 from cultivation of winter rye in the research sample and in selected farms from the agricultural regions of Poland (actual data)

Specification		Average in holdings cultivating winter rye	Average in selected holdings in region			
			Pomorze and Mazury	Wielkopolska and Śląsk	Mazowsze and Podlasie	Małopolska and Pogórze
Number of surveyed farms		119	32	36	39	12
Utilized agriculture area	[ha]	61.41	72.92	73.97	42.02	56,00
Growing area	[ha]	9.81	11.51	10.92	8.87	5.05
Yield of grain	[dt/ha]	38.1	44.8	37.5	30.5	44.2
Selling price of rye	[PLN/dt]	48.23	47.75	48.88	48.44	46.53
		Per 1 ha of growing area				
Total value of production	[PLN]	1870	2141	1885	1530	2064
Total direct costs	[PLN]	707	730	791	593	674
from this: sowing materials		170	191	186	130	163
fertilizers		423	414	469	382	412
organic fertilizers		1	3	-	-	-
plant protection products		98	102	122	70	71
growing regulators		12	13	12	11	15
other		4	7	2	0	13
Gross margin without subsidies	[PLN]	1163	1410	1094	937	1390
Total subsidies	[PLN]	881	889	862	893	895
form this: single area payment		462	462	462	462	462
payment for greening		310	310	310	310	310
additional payment		108	117	90	121	123
Gross margin	[PLN]	2043	2299	1956	1830	2284
Total labor input	[hours]	7.4	7.5	7.4	7.2	7.5
in this: own labor input		7.2	7.3	7.1	7.1	7.5
Indicators of economic efficiency						
Share of direct costs in gross margin without subsidies	[%]	60.8	51.8	72.3	63.3	48.5
Direct profitability indicator	[%]	264.5	293.1	238.3	257.9	306.2
Direct costs / 1 dt	[PLN]	18.57	16.29	21.12	19.46	15.26
Gross margin without subsidies / 1 dt	[PLN]	30.55	31.45	29.21	30.72	31.47
Gross margin without subsidies / 1 h of total labour input	[PLN]	157.99	188.31	148.53	130.29	184.64
Share of subsidies in gross margin	[%]	43.1	38.7	44.1	48.8	39.2

[-] – means that a given phenomenon did not occur.

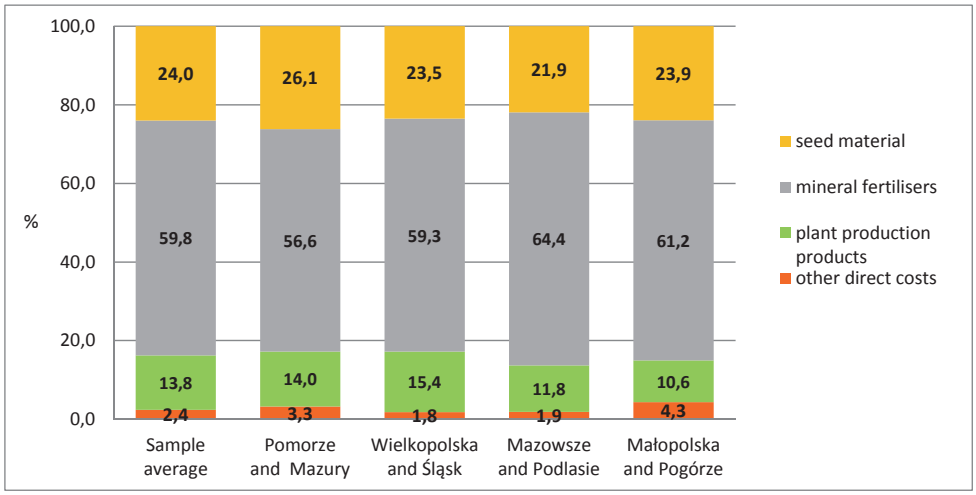
Source: prepared by the author on the basis of data of the AGROKOSZTY system.

When analysing the regional diversity of production and price results of rye, larger differences were observed in the case of the yield of grains than for its selling price. Comparing the maximum and minimum values, a difference in the case of yield amounted to 46.9% (i.e. 14.3 dt), whereas in the case of prices – 5.1% (i.e. PLN 2.35). Larger differences in the yield of grains are justified,

as they result from different climatic and soil conditions in particular regions of the country. The greatest yield of grains of rye (44.8 dt/ha) was achieved by producers from Pomorze and Mazury, and the smallest (30.5 dt/ha) in Mazowsze and Podlasie. On the contrary, the highest selling price of rye (PLN 48.88/dt) was recorded in Wielkopolska and Śląsk and the lowest (PLN 46.53/dt) in farms in Małopolska and Pogórze.

Production-price results of rye generated revenues from 1 ha at the level of PLN 1,530 – 2,141. The lowest revenues were achieved by producers from Mazowsze and Podlasie, and the highest by producers in Pomorze and Mazury. The lowest direct costs per 1 ha of rye were incurred in Mazowsze and Podlasie (PLN 593), and the highest in farms located in Wielkopolska and Śląsk (PLN 791). A comparison of the extreme values of these two categories, led to the conclusion that the location of farms differentiated revenues from cultivation of rye 3.1 times more than incurred direct costs.

Chart 2. The average structure of direct costs of cultivation of winter rye in the research sample and in selected farms from the agricultural regions in 2016 (per 1 ha of cultivation)



Source: study based on own research.

The structure of direct costs was dominated by the costs of mineral fertilisers (56.6-64.4%). The second position was occupied by the costs of seeds (21.9-26.1%), and the third by the costs of plant pesticides (10.6-15.4%) – Chart 2. In 2016 cultivation of rye resulted in achieving a gross margin which, however, was not very high. Gross margin without subsidies in the research sample amounted to PLN 1,163/ha, and in groups of farms – from PLN 937/ha in Mazowsze and Podlasie to PLN 1,410/ha in Pomorze and Mazury. The main

factor determining the amount of margin without subsidies were revenues which were the lowest in the first of the mentioned regions (PLN 1,530/ha), and the highest in the second region (PLN 2,141/ha). The difference resulting from a comparison of extreme values of the gross margin without subsidies obtained from 1 ha was PLN 473.

The support for farmers cultivating rye consisted in subsidies, the calculations consider single area payment, greening payment and additional payment. Their total amount granted for up to 1 ha of rye ranged between PLN 862-895. This means that, on average, in farms covered by the studies for PLN 1 of the gross margin without subsidies farmers received support in the amount of PLN 0.76, and in regions – from PLN 0.63 to 0.95.

The economic effectiveness of rye production in farms located in different parts of the country was measured using the direct profitability ratio. The average ratio for the examined group of farms was 264.5%, given that the lowest was recorded for farms from Wielkopolska and Śląsk – 238.3%, and the highest for Małopolska and Pogórze – 306.2%.

Calculations included in Table 2 show that variability of direct costs of production of 1 dt of rye was 1.4-times higher. The highest variability (PLN 21.12/dt) was recorded in Wielkopolska and Śląsk, and the lowest (PLN 15.26/dt) in Małopolska and Pogórze. On the contrary, the profitability of production of 1 dt of rye was similar and ranged between PLN 29.21-31.47. Larger differences are visible in profitability of labour inputs (PLN 130.29-188.31/hour). In farms from Mazowsze and Podlasie the profitability of labour inputs was the lowest, and in Pomorze and Mazury – the largest. A factor which caused this diversity was the gross margin without subsidies obtained from 1 ha of rye. It should be added that labour intensity of cultivation of 1 ha of rye was similar, in Mazowsze and Podlasie it was 7.2 hours, and in Pomorze and Mazury – 7.5 hours.

To sum up the results of the conducted analysis, it should be stated that regional differences in the amount of the gross margin without subsidies obtained from cultivation of rye were mainly determined by the value of production as a derivative production and price results. Impact of direct costs was weaker. The average gross margin without subsidies from 1 ha of rye in the sample was PLN 1,163. In terms of its amount the agricultural regions were classified as follows: 1) Pomorze and Mazury – PLN 1,410/ha, 2) Małopolska and Pogórze – 1,390/ha, 3) Wielkopolska and Śląsk – 1,094/ha, 4) Mazowsze and Podlasie – PLN 937/ha. The order of the regions did not change after considering subsidies. With subsidies the average gross margin from 1 ha of rye for the sample was PLN 2,043, and in the regions it ranged from PLN 1,830 to PLN 2,299. The average share of subsidies in the gross margin in the research sample was 43.1%, and in

farms from the agricultural regions it ranged between 38.7 and 48.8%. The impact of subsidies on the amount of the gross margin in all the groups of farms was similar. However, the greatest impact was observed in units where the gross margin without subsidies was the lowest, i.e. in Mazowsze and Podlasie.

Winter rapeseed. Insofar as rapeseed is concerned, Polish farmers cultivate winter rapeseed. According to GUS [49], the share of winter rapeseed in the structure of total sowings of rapeseed and turnip rape in individual farms in 2016 was 87.0%. The yield of winter rapeseed reached the level of 27.2 dt/ha (2.3% higher as compared to 2015). The yield was, however, regionally diversified. The average yield of winter rapeseed in individual farms located in Wielkopolska and Śląsk was the highest – 28.7 dt/ha. Subsequent positions in this regard are as follows: in Małopolska and Pogórze – 27.7 dt/ha, Pomorze and Mazury – 26.0 dt/ha, Mazowsze and Podlasie – 24.7 dt/ha. The average purchase price of rapeseeds in the country was PLN 161.67/dt (7.4% higher as compared to 2015)[50].

Evaluation of the regional diversity of the margin obtained in 2016 from cultivation of winter rapeseed was conducted using empirical data collected in 140 individual agricultural farms. The average results of the research are presented for the whole research sample and groups of farms located in four agricultural regions of Poland (Pomorze and Mazury, Wielkopolska and Śląsk, Mazowsze and Podlasie, and Małopolska and Pogórze).

The size of plantations of winter rapeseed in the studied farms was, on average, 17.74 ha. The yield of seeds in these units was at the level of 28.4 dt/ha, and were 4.4% higher than the average for individual farms in the country (27.2 dt/ha). On the contrary, the selling price of rapeseeds was PLN 157.86/dt and was 2.4% lower than the purchase price of rapeseed according to GUS (PLN 161.67/dt). In these production and price conditions the value of the potentially commercial production (i.e. revenues) from 1 ha of winter rapeseed amounted to PLN 4,479.

The analysis of yield of rapeseed in the regions led to the conclusion that the highest yield was obtained by farmers from Małopolska and Pogórze – 36.0 dt/ha, and the lowest by those from Wielkopolska and Śląsk – 24.8 dt/ha. Rather low yield was also obtained in Pomorze and Mazury – 26.7 dt/ha. It is worth noting that in both these regions yield of rapeseed was so low that it did not achieve the level obtained, on average, in individual farms in the country.

[49] *Production of agricultural and horticultural products in 2016.* Central Statistical Office (GUS), Warsaw 2017.

[50] *Procurement and prices of agricultural products in 2016.* Central Statistical Office (GUS), Warsaw 2017.

Table 3. The average production, costs and average gross margin obtained in 2016 from cultivation of winter rapeseed for the research sample and selected farms in the agricultural regions of Poland (actual data)

Specification		Average in holdings cultivating winter rapeseed	Average in selected holdings in region			
			Pomorze and Mazury	Wielkopolska and Śląsk	Mazowsze and Podlasie	Małopolska and Pogórze
Number of surveyed farms		140	31	47	35	27
Utilized agriculture area	[ha]	81.33	97.00	82.60	62.60	85.41
Growing area	[ha]	17.74	21.45	19.3	13.14	16.73
Yield of seeds	[dt/ha]	28.4	26.7	24.8	30.3	36.0
Selling price of rapeseed	[PLN/dt]	157.86	152.53	158.26	160.99	160.27
		Per 1 ha of growing area				
Total value of production	[PLN]	4479	4070	3932	4874	5774
Total direct costs	[PLN]	1804	1525	1964	1684	2015
from this: sowing materials		225	158	228	226	313
fertilizers		1033	866	1125	989	1139
organic fertilizers		4	16	-	-	-
plant protection products		451	378	510	425	466
growing regulators		32	49	21	28	34
other		59	58	80	16	63
Gross margin without subsidies	[PLN]	2675	2545	1968	3190	3758
Total subsidies	[PLN]	878	875	875	891	866
form this: single area payment		462	462	462	462	462
payment for greening		310	310	310	310	310
additional payment		106	103	103	119	94
Gross margin	[PLN]	3553	3421	2843	4081	4625
Total labor input	[hours]	8.5	8.2	8.3	10.1	8.0
in this: own labor input		8.3	8.0	7.9	9.8	7.9
Indicators of economic efficiency						
Share of direct costs in gross margin without subsidies	[%]	67.4	59.9	99.8	52.8	53.6
Direct profitability indicator	[%]	248.3	266.9	200.2	289.4	286.6
Direct costs / 1 dt	[PLN]	63.58	57.14	79.06	55.63	55.95
Gross margin without subsidies / 1 dt	[PLN]	94.28	95.39	79.19	105.36	104.32
Gross margin without subsidies / 1 h of total labour input	[PLN]	313.71	311.43	238.49	315.28	470.41
Share of subsidies in gross margin	[%]	24.7	25.6	30.8	21.8	18.7

[-] – means that a given phenomenon did not occur.

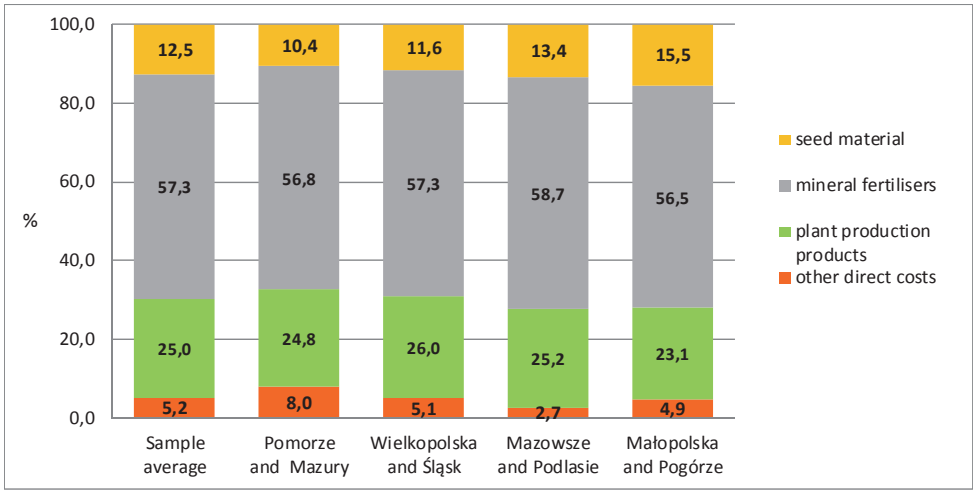
Source: prepared by the author on the basis of data of the AGROKOSZTY system.

The most favourable price for rapeseed was obtained by producers from the sample of farms from Mazowsze and Podlasie (PLN 160.99/dt), and Małopolska and Pogórze (PLN 160.27/dt). On the contrary, the lowest price was recorded in Pomorze and Mazury (PLN 152.53/dt). The highest yield and the high selling price of rapeseed obtained in farms from Małopolska and Pogórze ensured the

highest revenues – PLN 5,774/ha. On the contrary, the lowest revenues were recorded in farms from Wielkopolska and Śląsk – PLN 3,932/ha, this fact was determined the lowest yield (24.8 dt/ha), and relatively low selling price of seeds (PLN 158.26/dt) – Table 3.

The analysis demonstrated that the level of the gross margin without subsidies was strongly influenced by production and price results of rapeseed. Impact of direct costs was weaker. The average direct costs for the examined group of farms per 1 ha of winter rapeseed amounted to PLN 1,804. The highest variability of direct costs was recorded in farms from Małopolska and Pogórze (PLN 2,015/ha), and the lowest in Pomorze and Mazury (PLN 1,525/ha). According to the research, regardless of the region, a factor which predominantly shaped the level of direct costs was the cost of mineral fertilisers. Its share in the structure of direct costs ranged between 56.5 and 58.7%. Other very important factor was the cost of plant pesticides which, depending on the region, accounted for 23.1-26.0% of the direct costs – Chart 3.

Chart 3. The average structure of direct cultivation of winter rapeseed in 2016 for the research sample and selected farms in the agricultural regions (per 1 ha of cultivation)



Source: study based on own research.

In 2016, the cultivation of winter rapeseed at the level of the margin without subsidies was profitable. The average gross margin without subsidies in farms covered by the research was PLN 2,675/ha, given that in the regional perspective in ranged from PLN 1,968/ha in Wielkopolska and Śląsk to PLN 3,758/ha in Małopolska and Pogórze. The support for the producers of rapeseed consisted in subsidies, their total amount calculated per 1 ha ranged from PLN 866 to PLN 891, depending on the region. The average share of subsidies

in the gross margin in the sample (including subsidies) was 24.7%, while in the case of the agricultural regions it ranged between 18.7% in Małopolska and Pogórze and 30.8% in farms from Wielkopolska and Śląsk.

The research results demonstrate that in 2016 cultivation of winter rapeseed was also economically effective. The average direct profitability ratio in the sample was 248.3%, which means that the value of production exceeded incurred direct costs almost 2.5 times. The average value of the direct profitability ratio of rapeseed cultivation was the highest in Mazowsze and Podlasie (289.4%) and the lowest (200.2%) in Wielkopolska and Śląsk, i.e. in farms with the lowest gross margin without subsidies.

The advantage of rapeseed cultivated in Mazowsze and Podlasie, apart from the direct profitability ratio, is confirmed also by the results of economic efficiency ratios included in Table 3. For example, the highest profitability of production (PLN 105.36) was measured by the gross margin without subsidies per 1 dt of seeds. In addition, in this region the share of direct costs in the generated gross margin was the smallest (52.8%), which indicates a relatively high cost competitiveness. It should be added that the quoted results were, to a significant extent, determined by the lowest cost of production of 1 dt of rapeseeds (PLN 55.63).

The profitability of labour inputs for cultivation of rapeseed was the highest in farms in Małopolska and Pogórze. This is proven by the level of the gross margin without subsidies per 1 hour of labour inputs (470.41). It resulted both from the high value of gross margin without subsidies, and from the labour intensity of cultivation of 1 ha of rapeseed, which was the smallest in this region (8.0 hours, whereas in the remaining regions it ranges from 8.2 to 10.1 hours).

To sum up the results of the conducted analysis, it should be stated that the highest gross margin without subsidies from cultivation of winter rapeseed was obtained by producers in Małopolska and Pogórze – PLN 3,758/ha. The second position in this aspect was occupied by Mazowsze and Podlasie, the margin without subsidies amounted to PLN 3,190/ha. Economic efficiency (measured by the direct profitability ratio), namely the favourability of production in these regions was very favourable. On the contrary, in Wielkopolska and Śląsk results of winter rapeseed were least beneficial. The gross margin without subsidies obtained from 1 ha of rapeseed amounted to PLN 1,968 and the lowest as compared to other regions. Additionally, the average value of the direct profitability ratio was also the lowest (200.2%). Cultivation of rapeseed in this region was not cost-competitive, the share of costs in the gross margin without subsidies was 99.8%. In was largely affected by the highest (PLN 79.06/dt) direct cost of production of seeds per unit.

Sweet lupine. From among forage legumes cultivated for seeds sweet lupine has the greatest economic importance in Poland. In 2016 the share of the area of its cultivation in the total structure of sowings of forage legumes in the country was 57.5%. In individual farms the share of the area of cultivation of lupine was similar – 57.3%. The average yield of sweet lupine seeds in the country amounted to 15.9 dt/ha (16.0 dt/ha in individual farms – a 13.5% increase as compared to 2015) [51].

From the calculations made on the basis of the data of GUS[52] it seems that the highest average yield of sweet lupine was recorded in farms located in Małopolska and Pogórze – 17.3 dt/ha. The lower yield was obtained by producers in Pomorze and Mazury – 16.1 dt/ha. In Wielkopolska and Śląsk and in Mazowsze and Podlasie the average yield of lupine was even lower, accordingly, 15.7 and 15.4 dt/ha. According to GUS[53] In 2016 the average purchase price of forage lupine in the country amounted to PLN 82.95/dt (it increased by 2.7% as compared to 2015).

In 2016, the profitability of cultivation of sweet lupine at the level of gross margin was assessed as part of the research conducted in the AGRO-KOSZTY system. The research was conducted in 116 farms. The average results are presented for the entire research sample and for groups of farms from four agricultural regions of Poland. The purpose was to demonstrate differences and identify factors determining the amount of gross margin from cultivation of sweet lupine – Table 4.

In farms covered by the research the area of cultivation of sweet lupine was, on average, 6.06 ha, the average yield amounted to 15.9 dt/ha, and its selling price amounted to PLN 86.01/dt. On the other hand, in the agricultural regions the area sowed with lupine ranged from 3.76 ha in farms located in Mazowsze and Podlasie to 9.26 ha in Pomorze and Mazury. Differences are also visible in terms of production and price results.

[51] *Plant production in 2016.* Central Statistical Office (GUS), Warsaw 2017.
[52] *Production of agricultural and horticultural products in 2016.* Central Statistical Office (GUS), Warsaw 2017.
[53] *Prices in the national economy in 2016*. Central Statistical Office (GUS), Warsaw 2017.

Table 4. The average production, costs and gross margin obtained in 2016 from cultivation of sweet lupine in the research sample and selected farms from agricultural regions of Poland (actual data)

Specification		Average in holdings cultivating sweet lupine	Average in selected holdings in region			
			Pomorze and Mazury	Wielkopolska and Śląsk	Mazowsze and Podlasie	Małopolska and Pogórze
Number of surveyed farms		116	46	27	30	13
Utilized agriculture area	[ha]	62.23	82.93	59.44	41.97	41.47
Growing area	[ha]	6.06	9.26	4.28	3.76	3.77
Yield of sweet lupine	[dt/ha]	15.9	16.6	16.1	13.1	15.4
Selling price of sweet lupine	[PLN/dt	86.01	86.03	80.92	90.26	99.65
		Per 1 ha of growing area				
Total value of production	[PLN]	1363	1426	1299	1184	1533
Total direct costs	[PLN]	450	430	465	446	596
from this: sowing materials		224	223	199	224	290
fertilizers		121	123	139	112	81
organic fertilizers		3	-	-	-	49
plant protection products		88	73	112	100	140
growing regulators		10	7	11	10	29
other		4	4	4	-	7
Gross margin without subsidies	[PLN]	914	996	834	738	937
Total subsidies	[PLN]	1315	1293	1315	1342	1325
form this: payment for protein crops		421	415	429	430	430
single area payment		462	462	462	462	462
payment for greening		310	310	310	310	310
additional payment		122	106	114	140	122
Gross margin	[PLN]	2228	2289	2149	2080	2262
Total labor input	[hours]	5.5	4.2	6.7	7.4	9.4
in this: own labor input		5.4	4.1	6.4	7.2	9.2
Indicators of economic efficiency						
Share of direct costs in gross margin without subsidies	[%]	49.2	43.2	55.7	60.5	63.6
Direct profitability indicator	[%]	303.1	331.7	279.6	265.3	257.2
Direct costs / 1 dt	[PLN]	28.38	25.94	28.94	34.02	38.74
Gross margin without subsidies / 1 dt	[PLN]	57.64	60.09	51.98	56.23	60.91
Gross margin without subsidies / 1 h of total labour input	[PLN]	166.55	236.39	124.95	99.94	100.00
Share of subsidies in gross margin	[%]	59,0	56.5	61.2	64.5	58.6

[-] – means that a given phenomenon did not occur.

Source: prepared by the author on the basis of data of the AGROKOSZTY system.

The greatest yield of lupine was recorded in Pomorze and Mazury – 16.6 dt/ha. A bit smaller yield was recorded in Wielkopolska and Śląsk (16.1 dt/ha) and Małopolska and Pogórze (15.4 dt/ha), while the lowest was recorded in farms of Mazowsze and Podlasie (13.1 dt/ha). The highest price for seeds of

sweet lupine was obtained by producers from Małopolska and Pogórze – PLN 99.65/dt. In other regions the selling price was lower, in Mazowsze and Podlasie it amounted to PLN 90.26/dt, and in two remaining, i.e. Pomorze and Mazury and Wielkopolska and Śląsk, accordingly, PLN 86.03 and PLN 80.92/dt.

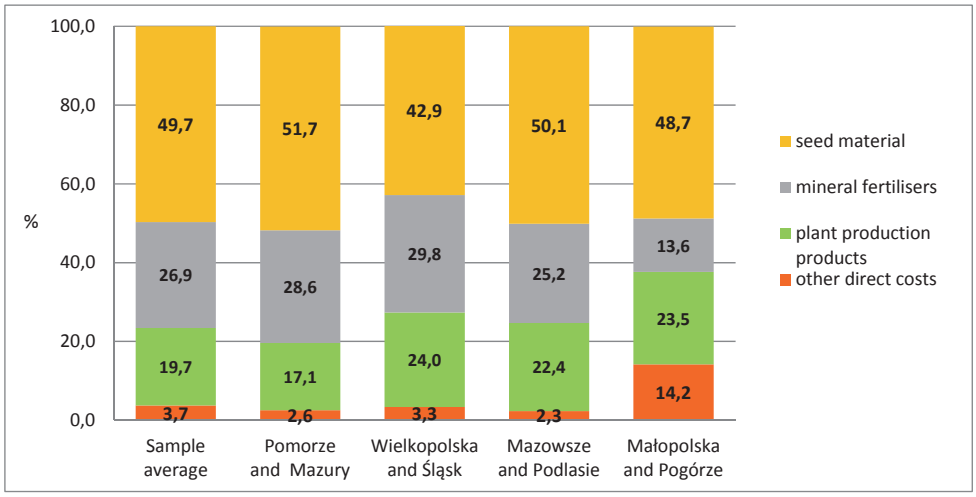
A point of reference for production and price results of lupine in the research sample of farms were the average results for the country. Calculations indicate that the average yield of sweet lupine in the studied farms was 0.6% lower than that obtained in individual farms in the country (16.0 dt/ha), while the selling price was 3.7% higher than the average for the country (PLN 82.95/dt).

Production and price results of sweet lupine in the research sample ensured the average revenues from 1 ha (the value of potentially commercial production) in the amount of PLN 1,363, and in the regions – from PLN 1,184 to 1,533. The lowest revenues were obtained by farmers from Mazowsze and Podlasie, and the highest by farmers from Małopolska and Pogórze. The location of farms differentiated the level revenues from cultivation of lupine more than the amount of sustained direct costs. To compare the extreme values, in the first case a difference calculated per 1 ha amounted to PLN 349, whereas in the second case – to PLN 166. The lowest direct costs of cultivation of 1 ha of lupine were recorded in Pomorze and Mazury (PLN 430/ha), and the highest – in Małopolska and Pogórze (PLN 596/ha) – Table 4.

The structure of direct costs was dominated by the cost of sowing material which constituted, on average, 49.7% in the research sample, and from 42.9 to 51.7% in the regions. The next position was occupied by the cost of mineral fertilisers; its average share was 26.9% in the research sample and 13.6 to 29.8% in the regions. On the contrary, the total average share of the costs of mineral fertilisers and plant pesticides was 46.6% in the research sample and in groups of farms – from 37.1% in Małopolska and Pogórze to 53.8% in Wielkopolska and Śląsk – Chart 4.

Economic results from cultivation of lupin sweet were measured by the gross margin without subsidies. The average was PLN 914/ha for the research sample, and for groups of farms – from PLN 738/ha in Mazowsze and Podlasie to PLN 996/ha in Pomorze and Mazury. As regards the results obtained from production, the role of subsidies as a factor supporting incomes of agricultural producers became more important. Their total amount granted for cultivation of 1 ha of sweet lupine was from PLN 1,293 to PLN 1,342. It means that, on average, in farms covered by the research farmers received a support in the amount of PLN 1.44, and in the regions – from PLN 1.30 to PLN 1.82 for each 1 PLN of gross margin without subsidies.

Chart 4. The structure of average direct costs of cultivation of sweet lupine in 2016 in the research sample and selected farms from the agricultural regions (per 1 ha of cultivation)



Source: study based on own research.

Economic efficiency ratios of production of seeds of sweet lupine are more synthetically illustrated by the research results; at the same time, they indicate the advantage of Pomorze and Mazury. In farms from this region cultivation of lupine was cost-competitive, which is confirmed by the smallest share of costs generated from the gross margin without subsidies (43.2%). The profitability of production and labour inputs was also high – PLN 60.09 and PLN 236.39, respectively. In the sample of farms located in Małopolska and Pogórze the economic efficiency of production of seeds of sweet lupine was the lowest; compared to farms from Pomorze and Mazury: the cost competitiveness of production was lower by 20.4 pp, the profitability of labour inputs – by 57.7%, technical labour productivity – by 59.0%, and economic labour productivity – by 51.7%.

The direct profitability ratio informs to what extent the costs incurred for production, expressed by the level of average direct costs, were reflected in an economic effect in the form of revenues. The average ratio in the research sample was 303.1%, which means that revenues exceeded incurred direct costs over 3--times. In the regional perspective, the highest economic efficiency was achieved by lupine cultivated in Pomorze and Mazury (331.7%), and the next positions were occupied by farms from Wielkopolska and Śląsk, (279.6%), Mazowsze and Podlasie (265.3%), and Małopolska and Pogórze (257.2%) – Table 4.

To sum up, it should be concluded that a factor which had a strong impact on the amount of gross margin obtained from cultivation of lupin sweet

was the value of production, being a derivative of production and price results. The impact of costs was also visible, which is confirmed by a different sequence of regions organised in terms of revenues and gross margin without subsidies. On average, the margin without subsidies from cultivation of 1 ha of lupine in the country amounted to PLN 914 in the research sample, and in to PLN 738-996 in the regions. As regards low results obtained from production, subsidies were a large support for producers of lupine. The average share of subsidies in the gross margin for the research sample (inclusive of subsidies) was 59.0%. Subsidies were the largest support for farmers cultivating lupine in Mazowsze and Podlasie, their share in the gross margin for the research sample was 64.5%. In other regions the average share of subsidies ranged from 56.5 to 61.2%. The average gross margin (inclusive of subsidies) from 1 ha of sweet lupine amounted to PLN 2,228, the highest margin was obtained by producers from Pomorze and Mazury (PLN 2,289), and the lowest in Mazowsze and Podlasie (PLN 2,080). Economic efficiency ratios also indicate the advantage of cultivation of sweet lupine in Pomorze and Mazury, while their least favourable values were recorded in Małopolska and Pogórze.

Forage pea. Economic importance of forage pea is lower than that of sweet lupine. This is proven by the share of pea in the structure of sowings of forage legumes, which in 2016 amounted to 6.3% in the country, and to 6.4% in individual farms. In 2016 forage peas was cultivated in Poland on the surface of 14,374 ha, including 91.6% of area located in individual farms. The yield of forage pea in individual farms amounted to 21.0 dt/ha (an increase by 11.1% as compared to 2015)[54], while the average purchase price of seeds in the country – PLN 75.28/dt (a 4.3% increase as compared to 2015)[55].

In 2016 studies were conducted aiming at evaluation of the production profitability of forage pea in Poland. The research sample was 81 farms in which data were collected describing the volume and the value of production of seeds of pea and incurred expenses and direct costs. The average results were presented for the research sample and separated groups of farms. They were selected using a criterion of regional location. The purpose of the research – like in the case of the previously discussed production operations – was to identify the production profitability of forage pea at the level of the gross margin and examine which factors determine its value.

An analysis of the production and price results led to the conclusion that the average yield of seeds of pea in the research sample amounted to 25.0 dt/ha, thus, it exceeded the average for individual farms by 19.0%. On the oth-

[54] *Plant Production in 2016. GUS,* Warsaw 2017.
[55] *Prices in the national economy in 2016.* Central Statistical Office (GUS), Warsaw 2017.

er hand, the selling price amounted to PLN 95.78/dt and was 27.2% higher as compared to the buying-in price of forage pea according to GUS. Regional segmentation of farms cultivating forage pea demonstrated a strong diversity of both yield of seeds of pea, and their selling price – Table 5.

Table 5. The average production, costs and gross margin obtained in 2016 from cultivation of forage pea in the research sample and selected farms of the agricultural regions of Poland (actual data)

Specification		Average in holdings cultivating forage pea	Average in selected holdings in region			
			Pomorze and Mazury	Wielkopolska and Śląsk	Mazowsze and Podlasie	Małopolska and Pogórze
Number of surveyed farms		81	18	24	19	20
Utilized agriculture area	[ha]	56.28	64.04	77.03	45.02	35.1
Growing area	[ha]	3.68	4.59	3.97	3.87	2.32
Yield of forage pea	[dt/ha]	25.0	27.6	25.0	19.3	29.5
Selling price of forage pea	[PLN/dt]	95.78	97.4	111.12	81.66	83.32
		Per 1 ha of growing area				
Total value of production	[PLN]	2397	2691	2779	1576	2455
Total direct costs	[PLN]	813	674	1036	722	746
from this: sowing materials		318	286	386	291	277
fertilizers		290	204	413	238	272
organic fertilizers		10	10	-	28	-
plant protection products		175	163	187	165	189
growing regulators		7	11	9	-	6
other		13	0	40	-	1
Gross margin without subsidies	[PLN]	1584	2017	1742	854	1709
Total subsidies	[PLN]	1274	1261	1291	1260	1293
form this: payment for of protein crops		403	410	412	367	430
single area payment		462	462	462	462	462
payment for greening		310	310	310	310	310
additional payment		99	79	107	121	91
Gross margin	[PLN]	2858	3278	3033	2114	3003
Total labor input	[hours]	6.3	5.1	6.4	6.2	8.2
in this: own labor input		6.0	5.1	5.6	6.2	8.2
Indicators of economic efficiency						
Share of direct costs in gross margin without subsidies	[%]	51.3	33.4	59.5	84.6	43.6
Direct profitability indicator	[%]	294.8	399.2	268.1	218.2	329.2
Direct costs / 1 dt	[PLN]	32.5	24.4	41.44	37.42	25.31
Gross margin without subsidies / 1 dt	[PLN]	63.29	73.00	69.68	44.24	58.01
Gross margin without subsidies / 1 h of total labour input	[PLN]	252.13	397.01	272.25	136.88	207.39
Share of subsidies in gross margin	[%]	44.6	38.5	42.6	59.6	43.1

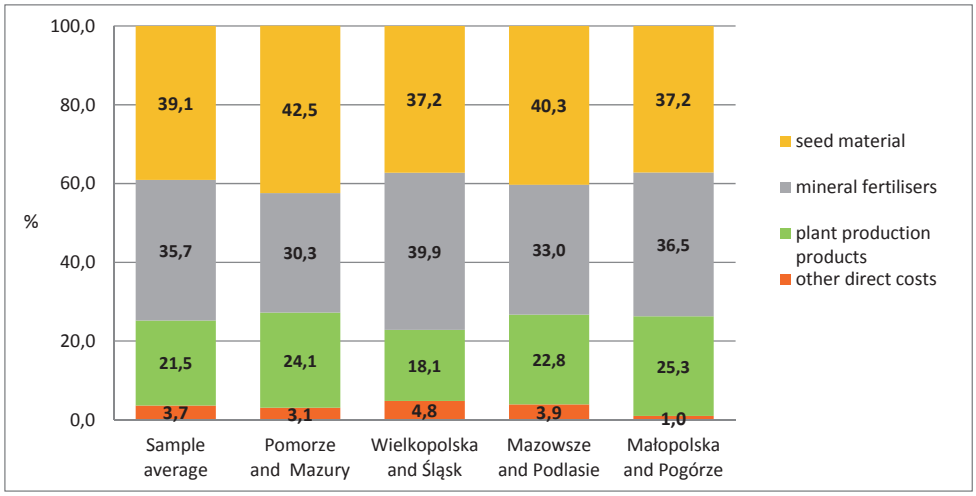
[-] – means that a given phenomenon did not occur.

Source: prepared by the author on the basis of data of the AGROKOSZTY system.

The highest yield (29.5 dt/ha) was obtained by farmers cultivating peas in Małopolska and Pogórze, and the lowest in farms from Mazowsze and Podlasie (19.3 dt/ha); a difference between those amounted to 10.2 dt. The highest price for seeds was obtained by producers from Wielkopolska and Śląsk (PLN 111.12/dt), while the least favourable (similarly to the yield) by producers from Mazowsze and Podlasie (PLN 81.66/dt); a difference amounted to PLN 29.46.

Differences resulting from the comparison of extreme values in the regions are large. Their impact on the level of revenues and the gross margin may be significant. In the analysed case – owing to the cumulation of both minimum values (i.e. yield and price) – this phenomenon was particularly evident in Mazowsze and Podlasie.

Chart 5. The structure of average direct costs of cultivation of forage pea in 2016 in the research sample and selected farms in the agricultural regions (per 1 ha of cultivation)



Source: study based on own research.

The average production and price results of pea are factors that determined the level of the gross margin without subsidies, but the impact of costs was also visible. An example are results of pea in Wielkopolska and Śląsk, which from the first position in terms of revenues (2,779/ha) dropped to the second in terms of the gross margin without subsidies (PLN 1,742/ha). The average revenues from cultivation of 1 ha of pea (the value of potentially commercial production) for the research sample amounted to PLN 2,397, and in groups of farms from the agricultural regions – PLN 1,576 - 2,779. The lowest revenues were obtained by farmers from Mazowsze and Podlasie, and the highest in Wielkopolska and Śląsk. The average direct costs incurred for cultivation of 1 ha of forage pea for the research sample amounted to PLN 813, and in groups

of farms: from PLN 674 incurred by producers from Pomorze and Mazury to PLN 1,036 in farms from Wielkopolska and Śląsk.

Within the structure of direct costs – like in the case of sweet lupine – the share of cost of seeds was higher than the cost of mineral fertilisers, on average, this share in the sample was 39.1 and 35.7%, respectively. An analogical situation was present also in farms classified in terms of regions, except these were just units from Wielkopolska and Śląsk, where the share of cost of mineral fertilisers was slightly higher (39.9%, whereas the cost of seeds – 37.2%) – Chart 5.

In 2016 economic results of cultivation of forage pea were quite favourable. Differences in the amount of the gross margin without subsidies observed between the regions resulted from interrelations between the production value, as a derivative of the yield and the selling price of seeds, and incurred direct costs. The highest gross margin without subsidies from cultivation of 1 ha of forage pea was obtained by producers from Pomorze and Mazury – PLN 2,017, and the lowest in Mazowsze and Podlasie – PLN 854 (the average margin without subsidies in the research sample amounted to PLN 1,584/ha). The support for the producers of consisted in subsidies, their total amount granted for up to 1 ha of forage pea ranged from PLN 1,260 to PLN 1,293. This means that for each 1 PLN of the gross margin obtained from production (i.e. without subsidies) producers of forage pea from the research sample received PLN 0.80, and producers from the regions – from PLN 0.63 to PLN 1.48. Subsidies were particularly important for producers of pea from Mazowsze and Podlasie. The margin without subsidies was relatively low (PLN 854/ha), and subsidies exceed it by as much as 47.5%.

Economic efficiency ratios describe the production effectiveness of forage pea in a broader aspect. Their values in farms from Pomorze and Mazury – as compared to other regions – were the most favourable. On the other hand, in Mazowsze and Podlasie the economic efficiency of production of pea was the weakest. Comparison of results of ratios in farms from Pomorze and Mazury with ratios in farms from Mazowsze and Podlasie led to the conclusion that, among others: direct costs of production of 1 dt of seeds were lower (by 34.8%), cost competitiveness of production was higher (2.5 times), the production profitability was higher (by 65.0%) and work outlays were higher (by 190.0%).

A measure of economic efficiency of production of seeds of pea was the direct profitability ratio. The average ratio for the research sample was 294.8%. In the regional perspective the highest economic efficiency was recorded for production of pea in Pomorze and Mazury (399.2%), and the next positions were occupied by farms from Małopolska and Pogórze (329.2%), Wielkopolska and Śląsk (268.1%), and Mazowsze and Podlasie (218.2%) – Table 5.

To sum up, it should be concluded that in 2016 cultivation of forage pea in the research sample was profitable. The research results indicate, however, large regional diversification of production and economic effects. If we compare maximum and minimum in the regions, the difference amounted to: in the case of yield of seeds – 52.8%, the selling price of seeds – 36.1%, revenues from 1 ha – 76.3%, direct costs incurred per 1 ha – 53.7% and the gross margin without subsidies obtained from 1 ha – 136.2%. As a consequence, the gross margin without subsidies obtained from 1 ha of forage pea ranged from PLN 854 to PLN 2,017, the lowest margin was obtained by producers from Mazowsze and Podlasie, and the highest in Pomorze and Mazury; the difference amounted to PLN 1,163. A factor which had a strong effect on the amount of the margin were revenues, namely the value of potentially commercial production. A regional location of farms affected the level of revenues stronger than direct costs. A difference between the extreme values in the first case amounted to PLN 1,203, and in the second – to PLN 362.

Subsidies had were crucial for producers of pea. With the addition of subsidies, the gross margin from 1 ha (inclusive of subsidies) ranged from PLN 2,114 in Mazowsze and Podlasie to PLN 3,278 in farms from Pomorze and Mazury. The share of subsidies in the gross margin in farms from Pomorze and Mazury amounted to 38.5%, and 59.6% in Mazowsze and Podlasie. The calculated values of economic efficiency ratios of production of pea confirm the advantage of Pomorze and Mazury; the least favourable values were recorded in Mazowsze and Podlasie.

Pork. According to the data of GUS, in December 2016 the pig population in Poland was 11 107.5 thousand heads and increased by 4.9% compared with December 2015[56]. The biggest increase was recorded for piglets and pregnant sows. This was likely effected by a higher profitability of breeding of pigs resulting mostly from a growth in purchase prices of pork livestock. In 2016, the average buying-in price of 1 kg of this livestock in Poland was PLN 4.68, whereas the buying-in price for particular provinces ranged from PLN 4.51/kg in the Małopolska Province to PLN 4.83/kg in the Western Pomorze Province[57]. On the other hand, taking into account the prices of pork livestock in the agricultural regions, the largest differences between the maximum and minimum price were recorded in Pomorze and Mazury (6.4%), and the smallest in Wielkopolska and Śląsk (1.9%). In Mazowsze and Podlasie and Małopolska and Pogórze the differences in prices were the same (3.1%).

[56] *The stock of pigs as at December 2016*, Central Statistical Office (GUS), Warsaw 2017.
[57] *Procurement and prices of agricultural products in 2016.* Central Statistical Office (GUS), Warsaw 2017.

The study assessed the profitability of production of livestock in 2016. Source data were collected from 120 individual pig fattening farms located throughout Poland. The economic balance focused on the first income category which is the gross margin. The average production and economic results of pork livestock were presented in the whole research sample and in groups of farms separated according to their location in four agricultural regions of Poland – Table 6. It should be added that the Polish "standard", according to the valid legislation, is that producers of pork livestock are not entitled to the support in the form of subsidies. As a result, the term "gross margin without subsidies" and "gross margin" are considered the same in this case[58].

In a set of farms covered by the research in 2016 the average gross production of pork livestock per farm (growth + weight of purchased animals) was 451.5 dt, given that the growth accounted for 56.2% of this production (253.7 dt). The selling price of pork livestock in these farms amounted to PLN 4.66/kg and was slightly lower (by 0.4%) from its average purchase price in Poland (PLN 4.68/kg). In separated agricultural regions the highest gross production of pork livestock was recorded in the group of farms from Małopolska and Pogórze – 608.6 dt/farm, and the lowest in Pomorze and Mazury – 285.2 dt/farm (the difference of 323.4 dt). In farms from other regions, i.e. from Wielkopolska and Śląsk and Mazowsze and Podlasie, the average gross production of pork livestock was, accordingly, 461.6 and 533.1 dt/farm. Despite a different gross production, the share of livestock growth was similar and ranged between 51.9 and 57.5%.

An analysis of price conditions of pork livestock led to the conclusion that the highest price for 1 kg (PLN 4.85) was obtained by producers in Małopolska and Pogórze and was 3.6% higher than the average purchase price of livestock in the country (PLN 4.68/kg). On the contrary, the lowest price of livestock (PLN 4.60/kg) was obtained in Wielkopolska and Śląsk, 1.7% lower than the average annual buying-in prices stated by GUS. It can be assumed that the level of prices is

[58] However, it is worth bearing in mind that farmers keeping pigs in 2016 could receive an extraordinary adjustment aid: 1) for producers of pigs from the area under restrictions due to ASF, in the form of refund of purchase costs of slaughter cattle; 2) for producers of pigs, in the form of a refund of purchase costs of pigs; 3) for producers of pigs, to adjust the selling price, in the area under restrictions due to ASF. In addition, producers of pigs were able to receive an extraordinary aid under support measures for the pork market in Poland. Subsidies were also received by breeders of domestic breeds of pigs (puławska, złotnicka biała and złotnicka pstra) – under the Agri-Environment Climate Scheme of the Polish RDP 2014-2020, package 7. "Preservation of endangered genetic resources of animals in agriculture" – see http://www.arimr.gov.pl; http://www.arr.gov.pl; http://www.minrol.gov.pl; http://strefa.agro.pl/rasy-rodzime-zwierzat-gospodarskich. However, producers of pigs had to fulfil special, strictly determined requirements. One cannot thus consider these payments as "normally" granted for pork livestock production.

related to the volume of livestock production, higher production could be an asset in price negotiations with processing plants.

Table 6. The average production, costs and gross margin obtained in 2016 from production of pork livestock in the research sample and selected farms in the agricultural regions of Poland (actual data)

Specification		Average in farms	Average in selected farms in region			
			Pomorze and Mazury	Wielkopolska and Śląsk	Mazowsze and Podlasie	Małopolska and Pogórze
Number of surveyed farms		120	29	47	34	10
Utilized agriculture area	[ha]	36.41	37.40	37.93	34.20	33.93
Net pigs production (weight gain)[a]	[dt/farm]	253.66	163.25	258.07	306.33	316.07
Gross pigs production[b]	[dt/farm]	451.46	285.15	461.62	533.08	608.56
Average weight of pigs for sale	[kg/unit]	115	114	114	119	107
Average sale price of pigs for sloughter	[PLN/kg]	4.66	4.72	4.6	4.63	4.85
		Per 100 kg of gross pigs production				
Total value of production	[PLN]	466	472	460	463	485
Total direct costs	[PLN]	423	416	417	410	494
from this herd replacement		269	258	248	272	347
off-farm fodder		98	94	105	94	93
on-farm fodder from commercial products		50	61	56	40	48
other		6	3	8	4	6
Gross margin without subsidies	[PLN]	43	56	43	54	-9
Subsidies	[PLN]	-	-	-	-	-
Gross margin	[PLN]	43	56	43	54	-9
Total labor input	[hours]	2.2	3.1	2.4	1.7	1.5
in this: own labour input		2.1	2.9	2.2	1.7	1.3
Indicators of economic efficiency						
Relation of direct costs to gross margin without subsidies		9.84	7.43	9.70	7.59	x
Direct profitability indicator	[%]	110.1	113.5	110.3	112.9	98.2
Relation of unit of direct cost to price of 1 kg of pigs		0.91	0.88	0.91	0.88	1.02
Gross margin without subsidies / 1 h of total labour input	[PLN]	19.38	17.86	17.57	30.65	x
Production value /1 hour of total labour inputs	[PLN]	211.38	150.57	188.71	264.70	333.30

[a] net production of livestock is an annual growth in weight obtained in a herd of porkers.
[b] Growth+ weight of purchased animals.
[-] – means that a given phenomenon did not occur.
[x] – means that making of calculations was not justified.
Source: prepared by the author on the basis of data of the AGROKOSZTY system.

The research results demonstrate that the ranking of regions in terms of the production value, namely revenues per 100 kg of livestock and obtained gross margin, was different. In this way the impact of direct costs on the results became visible. Their level calculated per 100 kg of gross livestock ranged from PLN 410 in farms from Mazowsze and Podlasie to PLN 494 in Małopolska and Pogórze.

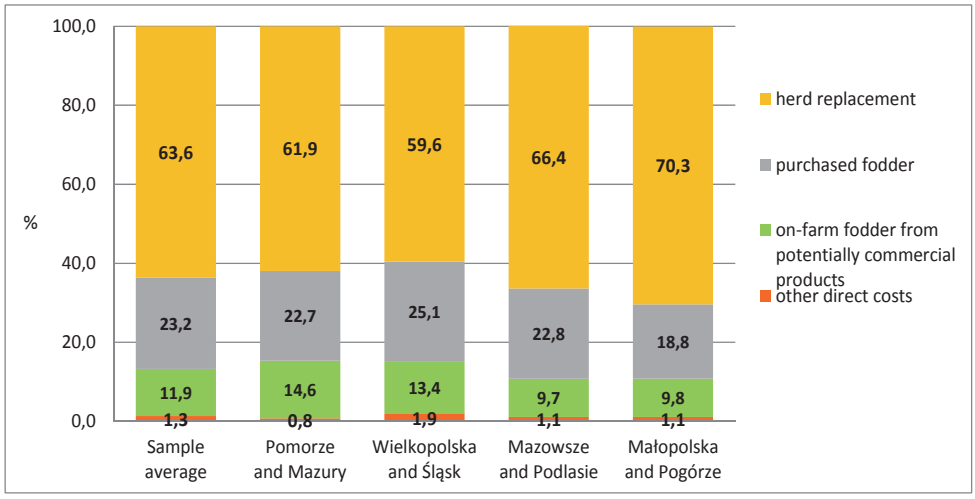
The research proved that the regional location of farms from the research sample have a greater impact on direct costs per 100 kg of pork livestock than on revenues obtained from this production. In the first case, the difference between the highest and the lowest level amounted to PLN 84, and in the second case to PLN 25. Large discrepancies could also be noticed when comparing some cost elements between the regions. For example, the difference between the highest (PLN 347 in Małopolska and Pogórze), and the lowest herd replacement cost (248 PLN in farms from Wielkopolska and Śląsk) amounted to PLN 99. On the contrary, the difference between the highest (PLN 161 in Wielkopolska and Śląsk) and the lowest (PLN 134 in Mazowsze and Podlasie) cost of fodders (on-farm and off-farm) was PLN 27. The regional diversity of the cost of animals entering the herd was 3.7 times higher than the cost of fodders (on-farm and off-farm) – Table 6.

It is also worth mentioning the cost of fodders used per 100 kg of growth of pork livestock. It was calculated that the average cost of fodders (on-farm and off-farm) in the research sample was PLN 264, the highest level (PLN 288) was recorded in Wielkopolska and Śląsk, and the lowest (PLN 232) in Mazowsze and Podlasie. Thus, the maximum value was 1.2-times higher than the lowest value. It, at least to some extent, reflected skills of farmers from the examined farms with regard to effectiveness of nutrition of porkers. The research proved that concentrated fodder have the greatest share in the feed ration. On average, 52.5% of concentrated fodder used per 100 kg of livestock growth in the research sample came from outside the farm, and 47.5% – from own production. Grains and meals from cereals constitute a large part of these fodder: 26.6% – in the case of purchased fodder, and 96.9% – in the case of own fodder. It is also worth noting that pork production farms from Małopolska and Pogórze operating at a losses already at the level of the gross margin were characterised by the largest share of grains and meals from cereals (37.9%) within the structure of purchased concentrated fodder used by the farm. This share was 2.1-times higher than in Mazowsze and Podlasie, where it was the smallest (18.1%).

An analysis of the structure of direct costs of production of pork livestock led to the conclusion that in all examined groups of farms the herd replacement cost had the greatest share, and was followed by the cost of purchased fodder, cost of own fodder from commodity products and other direct

costs. This structure was rather little differentiated from region to region. The research made it visible, however, that – as compared to farms from other regions – the largest share of the herd replacement cost (70.3%) was recorded for farms from Małopolska and Pogórze. These farms have also the smallest share of cost of purchased fodder (18.8%), as well as a relatively small share of the cost of own fodder from commodity products (9.8%). On the contrary, the smallest share of the herd replacement cost (59.6%) was recorded for farms from Wielkopolska and Śląsk, however, they have the largest share of the cost of fodder from outside the farm (25.1%) and a relatively large cost of own fodder from commodity products (13.4%). It was calculated that in the case of the herd replacement cost and the cost of purchased fodder the difference between the extreme shares in direct costs was, accordingly, 10.7 pp and 6.3 pp. On the other hand, the difference between the largest (14.6%), and the smallest (9.7%) share of the cost of own fodder from commodity products was 4.9 pp. – Chart 6.

Chart 6. The structure of the average direct costs of production of pork livestock in 2016 in the research sample and in selected farms in the agricultural regions (per 1 ha of cultivation)



Source: study based on own research.

The research proved that in 2016 the gross margin from production of pork livestock in the research sample was realised. Its level was, however, small and amounted to PLN 43/100 kg of livestock. In three agricultural regions, i.e. Pomorze and Mazury, Wielkopolska and Śląsk and Mazowsze and Podlasie, it was also realised, and ranged from PLN 43 to PLN 56 per 100 kg of livestock. Only in Małopolska and Pogórze the gross margin was negative, which means that production of livestock generated losses (PLN 9/100 kg of

livestock) which resulted from relatively high direct costs incurred on livestock production.

Research findings were presented in a wider perspective using several economic efficiency ratios (Table 6). Calculations proved that in all groups of farms the relation between the unit direct cost to the selling price of livestock was very high. The lowest, namely relatively the most favourable (0.88) relation was recorded for Pomorze and Mazury, and Mazowsze and Podlasie, and the highest (1.02) in farms from Małopolska and Pogórze (in the first case, direct costs constituted 88% of the selling price of livestock, whereas in the second case they exceeded it by 2%). Relation of costs to the gross margin was also high. From among the regions where the gross margin was realised, the best result for this relation was recorded in Pomorze and Mazury (7.43), and the worst (9.74) in Wielkopolska and Śląsk. The highest profitability of labour inputs was recorded for farms from Mazowsze and Podlasie (PLN 30.65), whereas in Pomorze and Mazury, and in Wielkopolska and Śląsk this ratio was comparable, and amounted to PLN 17.86 and PLN 17.57, respectively. It is also worth mentioning that farms from Małopolska and Pogórze where production of pork livestock generated losses already at the level of the gross margin, were distinguished by their most beneficial result concerning the economic efficiency of labour inputs (PLN 333.30), whereas the worst result (PLN 150.57) was recorded for farms from Pomorze and Mazury.

The average profitability ratio of direct production of pork livestock (the relation between the production value and direct costs) in the research sample of farms was 110.1%. On the other hand, in groups of farms from three agricultural regions (Pomorze and Mazury, Wielkopolska and Śląsk, and Mazowsze and Podlasie) – it ranged from 110.3 to 113.5%. On the contrary, in farms from Małopolska and Pogórze production of livestock was unprofitable – the average direct profitability ratio amounted to 98.2%. This means that the production value was too low to fully cover direct costs.

To sum up the above, it should be stated that the gross margin from production of pork livestock was realised in three from four agricultural regions of Poland. The best results were achieved by producers of pork livestock in Pomorze and Mazury, the gross margin per 100 kg of livestock amounted to PLN 56. Somewhat lower results were achieved by farmers from Mazowsze and Podlasie and Wielkopolska and Śląsk – the margin was, accordingly, PLN 54 and PLN 43/100 kg of livestock. On the contrary, in Małopolska and Pogórze, the production of livestock generated losses already at the level of gross margin (a loss of PLN 9/100 kg). The direct profitability

ratio in this region amounted to 98.2%, whereas in other regions it ranged between 110.3 and 113.5%.

The herd replacement cost and the cost of fodder has a significant position in direct costs of pork production. Their level determined the amount of total direct costs. The regional diversity of the cost of animals introduced to the herd was 3.7-times larger than the cost of fodder (purchased and own). The concentrated fodder has the largest share in the feed ration. On average, 52.5% of concentrated fodder used per 100 kg of livestock growth in the research sample came from outside the farm, and 47.5% – from own production.

Cereals in organic farms. Certified organic farms use principles of organic farming[59]. In the case of plant production soil care recommendations are important – soil treatment is limited to a necessary minimum and should serve to improve fertility. General principles of soil care include treatments such as: shallow inversion and deep loosening, pairing tools in order to limit the number of passages and shorten time in which soil has no plant cover[60]. It is important to apply in organic farms a several-year crop rotation with legumes in the main crop, with the use of undersown crops and cover crops protecting soil against erosion. It is worth mentioning that organic farms may not use any herbicides. In the event that cultivations are threatened they may use plant pesticides containing only biologically active substances, microorganisms and living organisms[61]. Weeds are removed only mechanically, using harrows, ridgers, hoes and manual tools.

Fertilisation in organic farms is important in the case of plant production. Its use is aimed at maintaining or increasing the fertility and biological activity of soil and development of optimal conditions for development of plants. Basic fertilisers that can be used in organic farms include: manure, compost, liquid manure and green fertilisers. Fertilisation can be supplemented by mineral fertilisers, magnesium and carbonate lime, potassium fertilisers *(kainite, calimagnesia, potassium sulphate)*, phosphorite rocks, and others[62]. On the contrary, prohibited fertilisers include: synthetic nitrogen fertilisers,

[59] Basic legal acts concerning organic agriculture are: Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and Act of 25 June 2009 on Organic Agriculture.

[60] *Principles of organic cultivation of plants,* www.forumrolnictwaekologicznego.pl/index.php?option=com_ content&view=article&id=100&Itemid = 103 [access: 8.09.2017].

[61] The list of plant pesticides qualified for use in organic agriculture published on the website of National Research Institute of Plant Protection in Poznań.

[62] The list of fertilisers and agents improving soil properties qualified for use in organic agriculture is available on the website of National Research Institute of Soil Science and Plant Cultivation in Puławy.

guano, industrial fertilisers, controlled-release fertilisers and organic-mineral fertilisers produced industrially.

The important issue of organic plant production is also the quality of sowing material, which should come from an own farm or a different ecological cultivation. Agreed genetic varieties with high resistance to diseases and pests are preferred. It is prohibited to cultivate genetically modified plants. It is also unacceptable to dress seeds with synthetic agents, only natural substances are allowed, e.g. biodynamic preparations, compost extracts, plant extracts, etc. It is also prohibited to use synthetic plant hormones, such as: anti-development agents, substances stimulating branching or accelerating or slowing down ripening.

According to the data of GUS, the area of arable land with organic production in Poland decreased in the recent years. A total area of arable lands in certified farms and in converting farms in 2013 was 670.0 thousand ha, whereas in 2016 it decreased to 536.6 thousand ha. Organic producers claim that the reduction in acreage resulted from changes in the system of subsidies for organic farming, that make it necessary to produce organic products for the market, which requires greater involvement on the part of farmers[63].

It should be noted that cereals had a considerable share within the structure of arable lands in certified organic farms. In 2013, the total area of their cultivation was 17.9% (88.3 thousand ha), and in 2014 – 17.6% (97.7 thousand ha) of the total area of arable lands in organic farms[64]. Regionalisation is observed in the case of production of cereals in organic farms, a leading region was Pomorze and Mazury where in the period 2013-2014, production of cereals constituted more than 40% of their total production in Poland.

One should also note that cereals produced in organic farms enjoyed a high interest of processors in Poland. In 2014, 19.8% of all organic processing plants operated in "processing of products of milling of cereals" (23.8% in 2013). In 2014 the production volume (milling of cereals) amounted to 4.2 thousand tons, and was smaller by 13.7% than in 2013 (4.9 thousand tons)[65].

Organic farming is the management system which aims at reducing adverse effects of agriculture on the environment, but it is also an attempt to match ecological and economic objectives at the level of an agricultural farm[66]. Agricultural production in organic farms is not only the source of income for farmers, but is also important in terms of environmental protection,

[63] *Zmniejsza się powierzchnia upraw ekologicznych,* Sady i ogrody, Warszawa 2016.
[64] *Report on the condition of organic agriculture in Poland in 2013-2014,* GIJHAR-S, Warsaw 2015.
[65] *Report on the condition of organic agriculture in Poland in 2013-2014*, GIJHAR-S, Warsaw 2015.
[66] H. Runowski, *Zrównoważony rozwój gospodarstw i przedsięwzięć rolniczych*, Roczniki Naukowe SERIA, t. 2, z. 1, 2000, pp. 94-102.

thus it should prevent contamination of environment, and all forms of pollutants must be minimised.

A complex assessment of agricultural production in organic farms should consist not only in analysing production and economic results, but also in assessing the environmental impact of this production. The environmental sustainability (i.e. environmental friendliness of agricultural production) of ecological farms cultivating cereals may be assessed using ratios[67], e.g.

- share of cereals in the structure of sowings in arable lands,
- the number of groups of plants grown in arable lands,
- an index of vegetation coverage of arable lands in the winter period.

Information about the share of cereals in crops in arable lands is a statistical determinant of environmental friendliness of agricultural production, which characterises the correctness of crop rotation of plants and the degree of biodiversity of agrocenoses[68]. In the case of cultivation of cereals (e.g. wheat, rye) share in the structure of sowings above 66% should be avoided[69]. High share of cereals in crops makes it impossible to apply correct crop rotation of plants, which results in development of weeds, the spread of diseases, a greater risk related to pests and soil depletion with regard to organic matter[70].

Another index informing about the correctness of plant production organisation in a farm is the number of groups of plants grown in arable lands[71]. This index indicates the level of diversity of the structure of cultivations, which indicates selection possibilities and consequences of plants, as a result of which population of agrofags is limited, weed infestation is reduced and losses of nitrogen are minimised. It indicates the need for cultivation at least 3 groups of plants from among the following: cereals, legumes, root crops, oilseeds/industrial crops, grass in arable lands, and other cultivations (not classified to the listed groups).

The index of vegetation coverage of arable lands in the winter period is classified as one of agro-ecological indices determining the degree of implementation of sustainable production system in agriculture[72]. Maintenance of

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[67] W. Wrzaszcz, *Poziom zrównoważenia indywidualnych gospodarstw rolnych w Polsce,* Studia i Monografie IERiGŻ-PIB, no. 155, Warsaw 2012, p. 67.
[68] A. Faber, *Ocena stopnia zrównoważenia rolnictwa w Polsce w różnych skalach przestrzennych,* Studia i Raporty IUNG-PIB, no. 20, Puławy 2010, pp. 9-27.
[69] J. Kuś, *Rola zmianowania roślin we współczesnym świecie,* IUNG, Puławy 1995. s. 34.
[70] J. Grabiński, *Problemy gospodarstw zbożowych*, Wieś Jutra, Zboża, nos. 3-4, Warsaw 2011, pp. 12-13.
[71] E. Majewski, E*konomiczno-organizacyjne uwarunkowania rozwoju Systemu Integrowanej Produkcji Rolniczej (SIPR) w Polsce*, Wydawnictwo SGGW, Warsaw 2002.
[72] A. Harasim, *Regionalne zróżnicowanie pokrycia roślinnością gleb Polski, [in:] Wybrane elementy regionalnego zróżnicowania rolnictwa w Polsce*, Studia i Raporty IUNG-PIB, no. 15, Puławy 2009, pp. 71-80.

plant cover in the winter period prevents the negative effects of climatic factors, limits contamination of water and protects soil against erosion. The best protection of soil is possibly the largest vegetation coverage in the winter season, however, a minimum level of this index may be assumed, i.e. coverage of 33% of the surface area of arable lands. This index is calculated as a relation between the sum of areas sowed with winter cereals, catch crops in arable lands, grass in field cultivation for green forage and small-seeded legumes for green forage to the total surface area of sowings in arable lands.

In 2016 the research of agricultural products conducted within the AGROKOSZTY system, evaluated **winter wheat and winter rye cultivated in farms having certificate of compliance in organic farming.** The research sample was not large – 14 farms for wheat and 27 for rye. It is assumed that the research of these cereals will be carried out every year which will provide data for long-term studies. A small research sample in 2016 does not enable valid conclusions to be drawn. The research findings are mostly cognitive, and indicate differences in the profitability of cultivation of wheat and rye in organic farms. The study also presents the preliminary assessment of the environmental sustainability of farms, as well as the comparative analysis of the level production, sustained investment outlays and costs, as well as income in the form of gross margin per 1 ha of cultivation. The average results are presented for the research sample.

The research results indicate that, on average, in the research sample of ecological farms that cultivated:

- winter wheat – the yield of grains amounted to 29.4 dt/ha and was 34.5% lower than the average yield (44.9 dt/ha) in individual farms in the country; On the other hand, the selling price of grains amounted to PLN 79.68/dt and exceeded the average buying-in price of wheat in the country (according to GUS – PLN 62.02/dt) by 28.5%,
- winter rye – the yield of grains amounted to 18.9 dt/ha, therefore, was 33.5% lower that its average level in individual farms in the country (28.4 dt/ha); the selling price of grains of rye amounted to PLN 55.31/dt and exceeded by 6.9% the average buying-in price of rye in the country (according to GUS – PLN 51.73/dt).

The yield of grains and the price of its sale determined the level of revenues (the value of potentially commercial production) from cultivation of the examined cereals. In the research sample of organic farms the producers of winter wheat obtained PLN 2,345 from 1 ha, and more than 2 times less from 1 ha of rye – only PLN 1,054.

Table 7. Production, costs and gross margin obtained in 2016 from cultivation of winter wheat and winter rye in the research sample of organic farms (actual data)

Specification		Average in ecological holdings cultivating	
		winter wheat	winter rye
Number of surveyed farms		14	27
Utilized agriculture area	[ha]	33.32	36.94
Growing area	[ha]	4.44	8.31
Yield of grain	[dt/ha]	29.4	18.9
Selling price of wheat	[PLN/dt]	79.68	55.31
		Per 1 ha of growing area	
Total value of production	[PLN]	2345	1054
Total direct costs	[PLN]	400	146
from this: sowing materials		290	125
fertilizers		75	6
organic fertilizers		35	25
plant protection products		-	-
growing regulators		-	-
other		-	1
Gross margin without subsidies	[PLN]	1945	908
Total subsidies	[PLN]	1657	1682
form this: single area payment		462	462
payment for greening		310	310
additional payment		93	118
ecological payment		792	792
Gross margin	[PLN]	3602	2590
Total labor input	[hours]	9.1	5.8
in this: own labour input		8.9	5.7
Indicators of economic efficiency			
Share of direct costs in gross margin without subsidies	[%]	20.6	16.1
Direct profitability indicator	[%]	586.2	720.0
Direct costs / 1 dt	[PLN]	13.59	7.75
Gross margin without subsidies / 1 dt	[PLN]	66.09	48.07
Gross margin without subsidies / 1 h of total labour input	[PLN]	213.10	156.64
Share of subsidies in gross margin	[%]	46.0	65.0

[-] – means that a given phenomenon did not occur.

Source: prepared by the author on the basis of data of the AGROKOSZTY system.

The value of production is the main factor determining the amount of the gross margin, although incurred direct costs are also important. The average direct costs per 1 ha of wheat in the examined set of farms amounted to PLN 400, and to PLN 146 in the case of rye. The main element of direct costs in the case of both the cereals was the cost of sowing material. Its share in the structure of costs, direct (total) costs incurred for the cultivation of wheat amounted to 72.4%, and 85.3% in the case of rye. The impact of other components of direct

costs, i.e. purchased mineral and organic fertilisers was low. The gross margin without subsidies obtained from the cultivation of 1 ha of winter wheat amounted to PLN 1,945, and PLN 908 in the case of winter rye (Table 7).

The support for revenues obtained from production consists in subsidies. In 2016 producers cultivating cereals in organic farms were entitled to receive single area payment, greening payment, additional payment and ecological payment[73]. Financial support per 1 ha of wheat (PLN 1,657) and rye (PLN 1,682) was similar. However, the influence of subsidies on the amount of the gross margin was different – significantly higher in the case of rye. This is proven by e.g. the share of subsidies in the gross margin calculated along with subsidies that amounted to 65.0%, and to 46.0% in the case of winter wheat.

The economic efficiency of winter wheat and winter rye in organic farms was evaluated using the direct profitability ratio (relation between the value of production to direct costs). The average ratio in the sample of farms cultivating wheat and rye amounted to 586.2% and 720.0%, respectively. Such a high direct profitability ratio resulted mainly from very low direct costs incurred for cultivation of these cereals.

The table 7 presents a set of indicators for the purpose of more detailed analysis of the economic results from cultivation of wheat and rye. Calculations indicate that direct costs of production of 1 dt of grains of rye were significantly lower (by 43.0%) than in the case of grains of wheat. The profitability of production of rye measured by the gross margin without subsidies per 1 dt of grains was also lower (by 27.3%). This was determined by the value of production per 1 dt of grains, which was lower by 30.1%.

Using basic information concerning the structure of cultivations, area of arable lands and arable lands, the preliminary assessment of the environmental sustainability of organic farms producing winter wheat and winter rye was conducted. For this purpose, the following indicators were used:

1. the share of cereals in crops of arable lands per farm (it should not exceed 66%); the average ratio in the sample of organic farms cultivating:

- winter wheat – 59.0%,
- winter rye – 60.0%.

The size of the ratio indicates the fulfilment of the requirement guaranteeing the correctness of crop rotation of plants and the degree of biodiversity of cultivations in organic farms;

[73] The granted organic farming payment is realised under European Agricultural Fund for Development of Rural Areas, "Organic Farming", package 7. Agricultural cultivations after the period of conversion.

2. the number of groups of plants grown on arable lands – this ratio is characterised by the degree of diversity of the structure of crops in the farms (recommended cultivation of at least 3 groups); from the calculations made on the basis of variables from databases it seems that these requirements were met by:

- 85.7% of farms cultivating winter wheat,
- 92.6% of farms cultivating winter rye.

The size of the ratio indicates that the majority of examined farms meets the requirement of diversity of the structure of crops on the farms;

3. index of coverage of arable lands with vegetation in the winter period – this ratio is classified into agro-ecological indicators determining the degree of implementation of the sustainable system of production in agriculture (the assumed minimum level – coverage of 33% of the surface area of arable lands); the index of coverage of lands with vegetation in the winter period in the case of cultivation of:

- winter wheat – 58.4%,
- winter rye – 52.4%.

The size of the ratio indicates that, on average, in groups of organic farms cultivating these cereals, the presence of cultivations during the winter (vegetation coverage) significantly exceeded the assumed minimum level. On average, more than a half of the surface area of arable lands in the sample were covered by vegetation during the winter.

To sum up the results of the analysis, it should be stated that the production of winter wheat and winter rye in organic farms made it possible to obtain the gross margin without subsidies. Its level reflected relations between revenues with sustained direct costs. In the research sample of farms, the gross margin without subsidies from cultivation of 1 ha of wheat amounted to PLN 1,945, and PLN 908 in the case of rye; taking account of subsidies, it was, accordingly, PLN 3,602 and PLN 2,589. The yield of grains of both wheat and rye was lower than the average result for individual farms in the country, whereas the selling price of grains was higher than the average buying-in price in the country. Revenues from production of wheat and rye significantly exceeded incurred direct costs (5.9 and 7.2-times, respectively), which was expressed by a high direct profitability ratio.

The preliminary assessment of the environmental sustainability of organic farms producing winter wheat and winter rye indicates a considerable degree of adjustment of these farms to agri-environmental requirements. The organisation of production in groups of the examined farms cultivating the discussed cereals maintained the relevant crop rotation of plants and the degree of diversity within the structure of crops in the farms, as well as a high degree of implementation of the sustainable system of production in agriculture.

Summary

The chapter presents economic results of plant and animal production operations, that were covered by the research within the AGROKOSZTY system in 2016. The object of studies in conventional farms were: winter wheat, winter rye, winter rapeseed, sweet lupine, forage peas and porkers (i.e. pork livestock), while in organic farms – winter wheat and winter rye. Farms covered by the research were selected in a purposeful manner, from a representative sample of farms, which was located in the field of observation of the Polish FADN.

Results were presented as averages for the set of farms covered by the research and for groups classified according to the location in the agricultural regions of Poland, i.e. Pomorze and Mazury, Wielkopolska and Śląsk, Mazowsze and Podlasie, and Małopolska and Pogórze. The purpose of the study was to indicate the main factors that guarantee the regional diversity of the production profitability. The conducted research covered only a percentage of individual farms in Poland. In spite of that, it is assessed that they faithfully reflect the direction of change in the level of costs, the gross margin, and provide a reliable picture of changes in the profitability in separated groups.

In 2016 **winter wheat** at the level of the gross margin was profitable. On average, on farms covered by the research, the margin without subsidies obtained from 1 ha amounted to PLN 2,123, and in agricultural regions – from PLN 1,945 PLN in farms from Mazowsze and Podlasie to PLN 2,399 PLN in Pomorze and Mazury. The amount of the gross margin without subsidies was determined by a specific combination of the yield, price and direct costs. However, the influence of revenues (as a derivative of the yield and the price) was higher than for incurred costs. Research findings proved that the regional location of farms cultivating wheat diversified the average direct costs slightly more (1.1-times) than revenues did.

Subsidies granted for 1 ha of wheat ranged from PLN 848 to PLN 884/ha. The average gross margin in the sample, calculated with subsidies, amounted to PLN 2,992/ha, and in regions – from PLN 2,829 to PLN 3,258/ha; subsidies ranged from 26.3 to 31.2% of its level. Economic results of winter wheat in farms located in Pomorze and Mazury were the most favourable. It is indicated by the highest gross margin without subsidies (PLN 2,399/ha), but also the highest economic efficiency (299.9%), production profitability (PLN 40.74/dt), labour profitability (PLN 308.83/h) and cost competitiveness, which is proven by the lowest share of the gross margin without subsidies (50.0%). On the contrary, least favourable results were provided by winter wheat cultivated in Mazowsze and Podlasie.

In 2016, cultivation of **winter rye** let the farms achieve the gross margin, but its value was significantly lower than obtained from cultivation of winter wheat. The average gross margin without subsidies from 1 ha of rye in the research sample amounted to PLN 1,163, and in groups of farms from PLN 937/ha in Mazowsze and Podlasie to PLN 1,410/ha in Pomorze and Mazury. A factor stimulating the level of the gross margin without subsidies are revenues. The research findings demonstrate that the regional location of farms cultivating rye differentiated direct costs 3.1-times more than revenues. After considering subsidies granted for cultivation of rye (PLN 862-895/ha) the average gross margin (with subsidies) in the sample amounted to PLN 2,043/ha, and in regions – from PLN 1,830 to PLN 2,299/ha. The average share of subsidies in the gross margin calculated with subsidies in the sample was 43.1%, and in farms from the agricultural regions – from 38.7 to 48.8%.

The profitability of rye in percentage – expressed as the relation of revenue to direct costs – was different in separated groups of farms. The average direct profitability ratio in the sample amounted to 264.5%, and in the regions – from 238.3% in farms from Wielkopolska and Śląsk to 306.2% from Małopolska and Pogórze.

In 2016, the average gross margin without subsidies from cultivation of 1 ha of **winter rapeseed** in the examined farms amounted to PLN 2,675, and in groups of farms located in the agricultural regions: from PLN 1,968 in Wielkopolska and Śląsk to PLN 3,758 in farms from Małopolska and Pogórze. The amount of the gross margin was largely influenced by revenues, whereas, the influence of direct costs was lower. An additional support for the producers of rapeseed deliveries were subsidies. Their amount granted for cultivation of 1 ha of rapeseed ranged between PLN 866 and PLN 891. After considering subsidies, the average gross margin (i.e. calculated with subsidies) in the research sample amounted to PLN 3,553/ha, and in the regions – from PLN 2,843 to 4,625/ha.

The most favourable results of indicators that illustrate the economic efficiency of production of rapeseed were recorded in Mazowsze and Podlasie and Małopolska and Pogórze. In the first region the highest profitability direct ratio (289.4%), the highest production profitability ratio (PLN 105.36) and high cost competitiveness were recorded, the latter of which is proven by the lowest share of costs in the margin without subsidies (52.8%). On the contrary, in Małopolska and Pogórze the labour profitability was the highest (PLN 470.41/h), which was influenced by the lowest labour intensity of cultivation (8.0 h/ha). In Wielkopolska and Śląsk the production efficiency of winter rapeseed was the least favourable. It is demonstrated e.g. by a relatively low direct profitability ratio (200.2%), as well as high direct costs of production of 1 dt of seeds (PLN 79.06). As a con-

sequence, the share of direct costs in the gross margin without subsidies was as high as 99.8%. This means that cultivation of rapeseed in this region was not cost--competitive.

In 2016 cultivation of **sweet lupine** at the level of the gross margin was profitable. The average gross margin without subsidies obtained in the research sample from 1 ha of lupine amounted to PLN 914, and in the agricultural regions from PLN 738 in Mazowsze and Podlasie to PLN 996 in Pomorze and Mazury. A factor that strongly influenced the amount of the gross margin without subsidies are revenues (the value of potentially commercial production), although the impact of direct costs was also visible. The regional location of farms differentiated revenues 2.1 more than sustained costs did.

Subsidies (total) granted for 1 ha of lupine ranged from PLN 1,293 to PLN 1,342 and exceeded the average gross margin without subsidies in the sample by 43.9%, and in the regions from 29.8% in farms from Pomorze and Mazury to 82.0% in farms from Mazowsze and Podlasie. After considering subsidies, the average gross margin in the sample amounted to PLN 2,228/ha, and in the regions – from PLN 2,080 to PLN 2,289/ha.

The economic effectiveness of production of lupine was evaluated using the direct profitability ratio which, on average, amounted to 303.1% in the studied sample of farms. The highest economic effectiveness was recorded for lupine cultivated in Pomorze and Mazury (331.7%), whereas the lowest – in Małopolska and Pogórze (257.2%).

In 2016, the gross margin without subsidies from cultivation of **forage peas** was realised and the average for the research sample of farms amounted to PLN 1,584/ha. In the groups of farms the highest margin without subsidies was obtained by producers of peas from Pomorze and Mazury (PLN 2,017/ha) and the lowest by producers from Mazowsze and Podlasie (PLN 854/ha). The amount of the margin without subsidies determined the production value, being a derivative of production and price results. The regional location of farms cultivating forage peas differentiated revenues 3.3 times more than incurred direct costs did. A difference between the extreme values in the first case amounted to PLN 1,203, and in the second – to PLN 362.

Subsidies (total) granted for 1 ha of peas ranged between PLN 1,260 and PLN 1,293. The average share of subsidies in the gross margin with subsidies in the sample was 44.6%, and in groups of farms from 38.5% in Pomorze and Mazury to 59.6% in Mazowsze and Podlasie. After considering subsidies, the average gross margin in the sample amounted to PLN 2,858/ha, and in the regions – from PLN 2,114 to PLN 3,278/ha.

Results for cultivation of peas in farms located in Pomorze and Mazury were the most favourable, whereas the leas favourable were recorded in Mazowsze and Podlasie. This is proven by both the level of the gross margin and the direct profitability ratio, that amounted to 399.2 and 218.2%, respectively.

The research findings indicate that in 2016 the income situation of production of **pork livestock** was unfavourable. The average gross margin obtained from 100 kg of livestock in the research sample amounted to only PLN 43. Additionally, in the sample of farms located in Małopolska and Pogórze producers sustained a loss – PLN 9/100 kg of livestock. On the contrary, in the sample of three agricultural regions, i.e. Pomorze and Mazury, Wielkopolska and Śląsk and Mazowsze and Podlasie, the average gross margin obtained from 100 kg of pork livestock ranged from PLN 43 to PLN 56. The amount of the gross margin was determined both by the selling price of livestock and direct costs of its production, however, the impact of the costs was greater. The regional location of farms differentiated the unit direct production costs 3.4-times more than the price of 1 kg of livestock did. The average direct profitability ratio of pork livestock production in the sample was 110.1%, and in the regions – from 98.2% in farms from Małopolska and Pogórze to 113.5% in Wielkopolska and Śląsk.

In 2016, the cultivation of winter wheat and winter rye in organic farms let the farms achieve the gross margin without subsidies, amounting to PLN 1,945 and PLN 908/ha, respectively. The main factor determining the amount of the margin was the production value, being a derivative of production and price results. The yield of grains of both cereals was lower compared to the average for individual farms in the country (by 34.5% for wheat and by 33.5% for rye), whereas, the selling price of grains was higher than the average buying-in prices in the country (by 28.5% for wheat and by 6.9% for rye). The direct profitability ratio of production of grains of wheat and rye amounted to 586.2% and 720.0%, respectively. Its amount was determined by very low direct costs incurred for cultivation of these cereals. Subsidies granted for cultivation of 1 ha of wheat and rye were high and amounted, accordingly, to PLN 1,657 and PLN 1,682. However, the strength of their impact on the amount of the gross margin was different. For 1 PLN of the margin without subsidies obtained from wheat cultivation farmers received support in the form of subsidies in the amount of PLN 0.85, and PLN 1.85, namely 2.2 times larger support, for cultivation of rye. As a result, the average gross margin with subsidies per 1 ha of wheat amounted to PLN 3,602, and PLN 2,589 in the case of rye.

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SUMMARY, CONCLUSIONS AND FINDINGS

The first chapter of the monograph outlines the conditions under which Polish farms will operate until the end of the current EU financial framework and during the next one.

Information from literature indicates that the technological economic and social changes launched in Europe approx. four hundred years ago have been driven primarily by institutional improvements connected with the rights revolution. In countries that have undergone this revolution, inclusive (incubator) economic institutions prevail nowadays. These institutions provide opportunities and incentives for the development of innovations and economic activity pursued by the largest possible part of the society. These incentives are based on the right to enjoy personal freedom and property rights and the right to their protection. The latter refers to the protection of the interests of innovators, wage earners and business people. Inclusive economic institutions must be supported in each country by inclusive public institutions. This means, among others, that there should be no barriers to entry into business or professional groups, and that the state should be centralized in such a way that the monopoly to use force, where necessary, in order to ensure independent political existence, security and the law and order in its territory is held by authorities that have been democratically chosen by the state's citizens. States that meet such criteria are referred to as liberal democracies.

Experiences of the past century show that the increase in the number of liberally democratic countries has been an important reason for: a decrease in the number of wars, an increase in the human population and the standard of living, as well as the progressive integration of the world.

Such development has, however, also side effects. Automation, robotization and digitization of the economy result in a growing number of excluded people who do not enjoy the benefits of this development. People who are dissatisfied due to being unemployed or achieving disproportionately low income are attracted by charismatic leaders who encourage them to rebel against the existing social order.

Various states around the world (Canada, Denmark, Germany, Switzerland, etc.) seek therefore practical solutions to reduce or even eliminate social exclusion. It turns out that experiences of a given country cannot be transferred to another if they do not correspond with local social norms and commonly shared ideas. We cannot, therefore, expect that the problem of excluded people will be quickly solved.

Furthermore, in the first decade of this century, intense extreme weather phenomena – droughts, floods and hurricanes – were reported in many areas in the world (Indie, Syria, Ethiopia, the USA, etc.) and to a lesser extent also in Europe. Cost-effective technologies of low-emission electricity generation and its transmission are thus being sought to reduce the adverse impact of the global community on climate. It is likely that this problem will be attempted to be solved through further innovations reducing the cost of currently known but unconventional, thus expensive, ways of low-emission electricity generation and limiting its losses during its transmission to customers. The search for appropriate solutions is likely to be continued in the longer run, so unfavorable climate change will be progressing by 2025.

In Poland, droughts are the most distressing extreme weather phenomena related to climate change. This problem can be solved by rebuilding existing small retention facilities or building new ones and undertaking relevant measures in agriculture and forestry. Such facilities and measures would be designed to reduce unproductive river runoff to the Baltic Sea. As regards drought consequences, these can be reduced by crop insurance which should be obligatory for as many farms as possible.

Historical experiences of economically developed countries show us also that social and economic development is not linear, but takes the form of generation cycles lasting approx. 80 years. The first half of the cycle is usually characterized by social equilibrium and economic development, whereas in the other one, social unrest grows and part of institutions cease to exist. The last 20 years of the generation cycle is the time of social crisis during which part of existing institutions are completely liquidated and an outline of new ones, which will operate in the next cycle, is emerging.

The current generation cycle started with the end of World War II, and the period of social crisis began in 2008 with the outbreak of global economic recession. This means that the time of social crisis will continue until the late 2020s. History teaches us that the course of social events is not necessarily peaceful. In the most optimistic scenario, economic processes, primarily those related to investment, will be hindered.

More detailed findings, also from literature, show that by the mid of 2020s, agricultural products will continue to be in demand worldwide and their production will be profitable. Agricultural income will be, however, limited by even faster growing prices of inputs purchased by agricultural producers, losses resulting from increasingly unstable climate and the growing costs of undertakings aimed at reducing its unfavorable change.

The European Union will struggle to overcome the crisis caused by social exclusion, the influx of immigrants from world areas particularly affected by the consequences of climate change and conservative rule in some Member States. It cannot be, therefore, ruled out that part of the funds from the EU budget spent now on the implementation of the common agricultural policy will be allocated for more urgent objectives.

Reduced subsidies will lead to an increased concentration of agricultural production in those farms that operate effectively, so mainly larger ones. The rate of this process will be, however, restrained by the already mentioned uncertainty as regards investment, resulting primarily from unstable farming conditions.

The first chapter includes also analysis of changes which occurred in Polish agriculture after Poland's accession to the European Union. In 2004-2015, there was an increase in gross value added at constant prices and without any subsidies, compared to 1998-2003. This means that the efficiency of agricultural production increased. This increase ceased in 2010-2015, and it is projected that this situation will continue at least by 2019. Nevertheless, Polish agriculture is one of the few in the European Union in which subsidies had a positive influence on farms' performance. This phenomenon may, however, reverse. It was mentioned in the previous paragraph that transformations taking place in the European Union may lead to a decrease in subsidy amounts. How will individual groups of domestic farms behave in this situation compared to similar groups in other EU countries in which subsidies had a negative influence on the efficiency of production, or in countries where such influence was not identified? This question needs to be answered urgently.

The second chapter of the presented monograph is devoted to evaluation of development capacity of medium-sized farms in 2010-2013. This is the second group subjected to such evaluation. In a similar monograph published in 2016, it was found that most of small farms were declining primarily due to lack of investment. This was because income earned from such farms per FWU was lower than a unit of wage for paid work in other farms where farm owners reproduced the value of held assets. Only a small proportion of small farms' owners decided to modernize their farms and reorganize production so that they were more open to the market.

The analysed group of medium-sized farms was thus joined by small farms as a result of their modernization and increased production, but at the same time this group was left by modernized farms boosting their potential, thus increasing the volume of their output over the medium level. Both processes partially offset each other, thus the number of medium-sized farms was fairly

stable. Being qualified as a medium-sized farm was, at least in some cases, just a transitory stage in their way from a small to a large farm.

The number of farms with SO of EUR 15-25 thousand remained stable in 2010-2013. They differed from other farms in the level of net income from the farm per FWU, which was slightly higher than a unit of wage for work in another farm. It follows from the foregoing that the aforementioned progressing increase in wages in the national economy will result in an increase in the size of such medium-sized farms, as the average wage level in the national economy is rather closely correlated with wages of hired agricultural workers.

The third chapter of the monograph includes the results of an analysis of unique issues, namely evaluation of achievements of farms afforesting part of their agricultural land. The analysis covered farms from 15 gminas, which afforested part of their land in 2004-2006, but their achievements were evaluated in 2006-2014 by comparing them with farms which chose not to do this. Farms which afforested part of their land had a 10.5 p.p. larger share of own agricultural land with V and VI of soil valuation classes. In the case of farms with SO of up to EUR 25 thousand this share was larger by 14.5 p.p., but both compared groups had a similar structure of agricultural types. It was found that farms which afforested part of their land were characterized by significantly lower return on equity and a lower value of the technical efficiency index. Worse economic effects were due to a significantly lower share of profitable crops in the sown area, agrotechnical deficiencies and significantly lower livestock productivity, which indirectly indicated deficiencies in zootechnical production procedures. Despite worse economic effects, farms which afforested part of their land were characterized by an average rate of reproduction of non-current assets, which attested to simple reproduction. The compared groups of farms differed insignificantly in this respect.

The countrywide scale of the analysed phenomenon was not large, as the percentage of farms which afforested part of their agricultural land in the years 2004-2006 did not exceed 0.5% of the total number of farms. The shortcoming of this analysis is a small sample of farms (15) which afforested part of their agricultural land.

The fourth chapter of the presented monograph includes characteristics of competitiveness of domestic cattle farms, compared to similar farms in selected EU countries. To this end, source materials from 2013-2015 were used.

The ability to compete was demonstrated by Polish, Hungarian and Lithuanian farms specializing in milk production and semi-large farms with SO of EUR 50-100 thousand, Polish large farms with SO of EUR 100-500 thousand and Hungarian and German very large farms with SO of more than EUR 500

thousand. A limited ability to compete was demonstrated also by Polish and Lithuanian farms with SO of EUR 25-50 thousand, as well as large German farms and very large Dutch farms. Only large Hungarian and Lithuanian farms were fully competitive.

As regards analysed non-competitive farms specializing in milk production, especially large and very large German, Danish and French farms, these were characterized by a predominant share of purchased feed, including roughage feed, in the total costs. This indicates a new trend, namely separating dairy farming from crop production.

The areas of farms specializing in milk production and able to compete varied significantly and were in the range of 22.5 ha of agricultural land (semi-small Polish farms) to 1,236 ha of agricultural land (very large Hungarian farms). The area of Polish farms specializing in milk production and able to compete was 81 ha on average, and was similar to that of German farms.

As regards the analysed cattle farms, the ability to compete was demonstrated only by Polish farms with SO of EUR 50-100 thousand and German farms with SO of more than EUR 500 thousand. The average area of their agricultural land was 56 and 417, respectively.

Subsidies were the main source of income in cattle farms. In Polish farms, their share in income was the lowest one and did not exceed 100% and 83% in those able to compete. In farms in other analysed countries, this share was more than 100%, and was the highest in semi-small German and French farms with SO of EUR 25-50 thousand (316%). This means that cattle farming would not be possible in most of EU countries without support in the form of subsidies.

The fifth chapter includes an analysis of determinants of the regional differences in production viability, measured by the relation of the revenue value without subsidies to direct costs. The analysis covered conventional production of: winter wheat, winter rye, winter oilseed rape, sweet lupine, fodder (field) pea and pig livestock, as well as organic production of winter wheat and winter rye in four macroregions of Poland: Pomorze and Mazury, Wielkopolska and Śląsk, Mazowsze and Podlasie as well as Małopolska and Pogórze. The analysis was made based on 2016 materials. The conclusions below refer only to the value of revenue and direct costs in conventional production.

– As regards the production of winter wheat, its profitability depended mainly on revenue, while the regional location of the analysed farms producing winter wheat differentiated the direct costs only slightly more than the revenue.

– In the case of winter rye production, its profitability was affected mainly by revenue as well, while the regional location of the analysed farms producing winter rye differentiated its level over than three times more than the direct costs.

– The profitability of winter oilseed rape was very strongly affected by revenue, while the location of farms with analysed plantations of this plant differentiated it level almost four times more than the amount of incurred direct costs.
– In the case of sweet lupine production, its profitability was affected more by the revenue, although the influence of the direct costs was observed as well, while the regional location of the analysed farms producing sweet lupine differentiated the revenue approx. two times more than incurred costs.
– The analysis of the profitability of fodder pea production showed its dependence mainly on the output value, while the regional location of the analysed farms producing fodder pea differentiated the revenue 3.3 times more than the direct costs.
– The profitability of pig livestock production in 2016 depended on the pig livestock price and direct costs, while the regional location of farms producing pig livestock differentiated over three times more incurred costs than the pig livestock price.
– Gross margins from organic production of winter wheat and winter rye calculated without subsidies per hectare of crops were lower by PLN 1,047 and PLN 1,136, respectively, i.e. by 35.0% and 55.6%, compared to conventional crops. The differences resulted in grain yields lower by 34.5% and 33.5%, respectively, grain selling prices higher by 28.5% and 6.9%, respectively, and in both cases very small direct production costs. Having taken subsidies into account in the revenue, the situation reversed. Organic crops yielded the gross margin per hectare of crops higher by PLN 610 and PLN 545, respectively, i.e. by 20.4% and 26.7%, compared to conventional production.

The above findings lead to two conclusions: The first one is the same as that formulated based on the 2016 studies, namely that any reduction in the level of subsidies in the next EU financial framework will accelerate the process of production specialization in the various regions of Poland, as the profitability of conventional crop production will depend in such a case mainly on yields and prices of products. Crop production will be, therefore, concentrated in those macroregions where these indicators will be more favourable. As regards conventional livestock production, its profitability will depend mainly on direct unit costs, which will be thus the main determinant of the scale and extent of this gated by agrotechnical and zootechnical progress, as well as growing marketing skills of agricultural producers.

The other conclusion drawn from the production profitability analyses presented in this chapter relates to organic farming. In case of a possible reduction in the level of subsidies in the next EU financial framework, the area under

organic crops will be significantly reduced or there will even be no such crops, unless such farming is supported by subsidies at the expense of subsidies to conventional farming.

It is obvious that an analysis based on empirical materials from one year cannot be the basis for inference as regards any changes in specialization of production in the various macroregions of Poland. The final conclusions in this respect will be drawn only in 2019, when the four-year period of analyses of this type comes to an end.

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