

**Agricultural company  
and agricultural holding  
towards climate  
and agricultural  
policy changes  
(2)**





INSTITUTE OF AGRICULTURAL  
AND FOOD ECONOMICS  
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# **Agricultural company and agricultural holding towards climate and agricultural policy changes (2)**

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## INTRODUCTION

A scientific-technical revolution started at the end of the 1940s and total resignation from the gold currency in the early 1970s opened new opportunities for increasing production and improving its effectiveness. This was made possible in agriculture as well. Both these phenomena allowed to use means of production being carriers of different forms of progress: technical, genetic, agrizootechnical, organisational, etc. Applied innovative means began to replace human labour and increase the productivity of land and animals for production. Removal of barriers driven by low number of credits facilitated modernisation of effective managing entities and increasing their assets. Industrialisation of countries combined with urbanisation and progress in the means of transport enabling agricultural products to be moved over long distances fostered an increase in demand for agricultural products and making use of surpluses of labour resources among the farming population. The work productivity in agriculture continued to increase also a result of adopting by the food industry certain types of processing of agricultural products which have been used in families of farm holders.

In Poland, these phenomena were used on a greater scale in the mid-1950s. Therefore, premises arose for commercialisation of private agriculture, but this could not happen on a wider scale earlier than after 1989. Changing socio-economic system into market system triggered attitudes of some farmers consisting in, first of all, putting an agricultural income and even a profit from resources invested in the farm at the first place among objectives they set for themselves. These motives forced to maximise the production value according to the logic of increase in marginal costs.

However, the situation was hardly encouraging at that time. Internal demand for agri-food products was limited for understandable reasons, and external demand over the recent decades has been limited owing to the increased productivity of agriculture in many countries. A demand barrier resulted in opening price scissors for agricultural products and for prices of means of production purchased by agricultural producers, and growth in work productivity in agriculture was levelled as a result of extra-job workers (“*dwuzawodowcy*” – minor agricultural manufacturers deriving a part of their income from work outside their own farms) losing their job because of changes taking place in non-agricultural sectors of the economy. Thus, income of the majority of agricultural families did not catch up with increase in income outside agriculture, which consequently limit the expansion of farms. An exception were larger farms with the total utilised agricultural area (UAA) amounting to 20-200 ha. They were the

only farms which increased their share in domestic agricultural production – by 10.5 percentage points in the period of 1996-2002.

An improvement in management conditions occurred no sooner than at the beginning of the first decade of the current century. PHARE and SAPARD programmes co-financed by the European Union became applicable at that time, providing funds for development of food economy. Despite relatively small amounts of support they played – as it turned out later – a very important role in customisation of this important sector of national economy to the production conditions which were to become valid after Poland's accession to the EU.

Obtaining access to the EU market was invaluable for Polish food producers because this market was secured by customs duties and non-tariff barriers before. It was a very large market, moreover, a comparative advantage of Polish food producers was revealed, as food production costs and prices of most food-stuffs in Poland were lower than in countries of the former EU-15.

In the first years after the accession, the degree of vertical integration of agriculture and processing was small, though constantly growing, yet the conditions imposed by companies processing raw materials of agricultural origin led to a change in production structures of agriculture at a quite stable structure of farms. Support measures received from the EU at fixed prices were this time significantly larger than those offered under PHARE and SAPARD programmes. They contributed to the further improvement in competitiveness of the national food economy and more sustainable development of agriculture and rural areas.

In 2011, the value of investments in domestic agriculture at current prices was by ca. 216% greater as compared to the situation in 2005. Pursued investments in combination with favourable changes in price scissors and direct subsidies resulted in a several-fold increase in the value of revenues in agriculture at current prices in 2003-2013. More or less at the same time, the costs of indirect consumption incurred for generating a unit of these revenues decreased by ca. 10%. As a result income of domestic agriculture at fixed prices was in 2013 larger by ca. 267% than the average annual income in 1998-2003.

Benefits of these transformations occurring in the Polish agriculture for a number of years did not cover all agricultural holdings. In 2000-2009 the number of farms owned by natural persons reduced by about 5%, and in 2010-2013 – by 6%. A reduction was observed in the number of farms of small sizes of agricultural production which were only an additional source of income for their holders and their families. Most of them ceased to be an independent undertaking, and only a small part thereof joined the group of farms with a greater



production value. However, this is still the largest group of farms in the Polish agriculture. The group of farms with the annual production value of PLN 60-100 thousand stood out with its stable number in 2010-2013<sup>1</sup>. The number of new developing farms with a smaller production value was almost equal to the number of those of them that managed to move to the group of farms with a greater production value. As a result, the number of farms with the annual production value exceeding PLN 100 thousand increased.

Changes taking place in the Polish agriculture were accompanied in the characterised period by unfavourable climate changes, effects of third wave of globalisation that began in 1980 and events occurring in the European Union since 2008. These phenomena brought a previously unrecorded growth in uncertainty and risk of management in agriculture. This uncertainty and risk are additionally intensified by ageing of population in Poland, which will intensify population outflow from agricultural holdings.

To answer the question about the effect these phenomena will have on further evolution of domestic agriculture until 2025, a large research project was undertaken in 2015 that was entitled “Agricultural company and agricultural holding towards climate and agricultural policy changes”. It was a part of a government multi-annual programme “The Polish and the EU agricultures 2020+. Challenges, chances, threats, proposals”, which will run until 2019. The presented monograph contains the research findings concerning the 2<sup>nd</sup> stage of implementation of this project, therefore, its title is identical with the title of the whole research project with the addition of [2]. Findings of this two-year research and other partial research projects implemented in 2017 and 2018 will be the basis for a summary study which will be published in 2019.

The monograph addresses agricultural farms owned by natural persons. Some of them are households with agricultural production, and some have characteristics typical of companies. A third group located somewhere between these groups may also be distinguished.

An inherent part of the presented monograph is an annex entitled “Projections of global situations in 2025”. These projections are a result of extrapola-

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<sup>1</sup> These amounts were determined using SO measure. It is the production value of a farm calculated using an index-based method and expressed in EUR thousand. Indicators are regionally diverse average prices from five years obtained from sales of particular agricultural products, excluding VAT and tax on products and direct subsidies. SO measure is the sum of products of particular cultivation areas, the number of animals according to their species, age and utility groups and respective indicators. It is assumed that 1 SO equals EUR 1,000 and PLN 4,000.

tion of two types of long-term trends. Both projections indicate the most general frames in which agricultural holdings will conduct their operations in 2025.

Chapter one of the monograph presents the analysis of small, semi-subsistence agricultural holding in 2011-2013. This provided – based on an analysis of two long-term trends and several medium-term and short-term trends (demand for agricultural products, barriers resulting from the situation of the EU agricultures, reduced share of working age people in the overall number of population) – for indication of likely operation of characterised farms in 2025. Furthermore, the chapter indicates actions whose implementation will facilitate overcoming barriers that hinder development of the analysed group of farms.

The three subsequent chapters of the monograph deepen and update the characteristics of selected aspects of agricultural activity. Such an approach required each time the use of source materials relevant to a given problem and specific methods of their analysis.

Chapter two addresses issues related to the functioning of agricultural farms in different natural and organisational conditions. The issue, addressed in the previous year, related to economic situation of the agricultural managing entities that run their business operations in the areas particularly prone to droughts in the vegetation period of crops. However, the presented monograph demonstrates the results of analysis which covered farms located on areas with unfavourable management conditions.

Chapter three continues the analyses of organisation and productivity of Polish agricultural farms in comparison to agricultural farms of the selected countries, which were initiated in the previous year. At that time, a successful attempt was taken to define the characteristics of farms specialising in field cultivations which stand out by the fact that they may become, or already are, competitive. A similar analysis in the presented monograph covered horticultural farms.

The next chapter of the monograph closely relates to the issue of major circumstances of the regional diversity of production profitability of selected agricultural goods produced in 2014 for farms with conventional and organic production, which was presented in the first monograph comprising a larger research project referred to above. The monograph, however, contains determinations concerning 2015, with an emphasis on the role of direct production costs as a factor largely dependent on the agricultural producer.

The presented monograph ends with a summary and conclusions.

# SEMI-SUBSISTENCE AGRICULTURAL HOLDINGS TOWARDS CLIMATE AND ECONOMIC CHANGES

## Introduction

Final production in agricultural farms of natural persons is divided into commodity (sold) and for self-supply, namely allocating parts of manufactured products on fulfilment of specific needs of farm holders and their families. Self-supply has its natural boundaries, thus farms engaging small resources of means of production are different from those engaging large production resources not only in terms of small commodity production, but also its smaller share in the total value of final production. Small farms are thus also semi-subsistence, therefore both these names will be used in this chapter interchangeably.

Limited contacts with the market (small sale and limited purchases of consumer goods by holders and their family) make semi-subsistence farms raising less interest than other larger farms, which are at the same time based to a greater or even fully on commodity production. No wonder that FADN (Farm Accountancy Data Network) monitoring in Poland and other EU countries covers only farms with the size exceeding specified limits.

On the above basis, it can be believed that smaller farms (semi-subsistence) are not regarded as business entities equivalent to commercial agricultural farms, but rather as social entities – households (families) carrying out agricultural production. It is quite right, since normally a greater part of their income does not come from agricultural production.

From literary studies it seems that our knowledge of semi-subsistence farms is based on partial research, pertaining largely to farms located in certain areas of the country the situation of which differs from the situation of other farms of this kind located in other areas. The chapter contains thus an analysis of all semi-subsistence farms of a given volume. The purpose of this analysis is to verify whether a climate change or change in economic policy, including agricultural policy change will have an effect in subsequent financial perspectives of the EU (2021 and several next years) on condition of semi-subsistence farms.

### **Semi-subsistence agricultural holdings in the light of national literature**

Advantages and disadvantages of small and large agricultural farms began to stimulate the interest of economists of Polish origin in the 19<sup>th</sup> century, when after the enfranchisement of some farm employees the peasant class began to shape [Musiał and Wojewodzic, 2015]. New holders of small agricultural farms

started to learn to manage “themselves” and often achieve poor production and economic results. Thus, there was a dominant opinion about the competitive advantage of large farms owned by gentry. At the end of this age, economists associated with circles of the so-called folk experts, began to undermine this thesis. They considered that management in small agricultural farms is a certain type of folk production, thus being the most beneficial form of management. This idea gained recognition. A view was also formed that “scrupulous and thoughtful” work of farm holders and members of their families “on their own” makes that small farms exhibit advantages as compared to gentry farms employing only wage workers. However, only family farms with their own tractive force and additionally employing wage workers were deemed successful, namely those being a form connecting small family farms and gentry farms. Small farms were, on the other hand, those that did not have their own tractive force and did not hire wage workers.

After World War I, in reborn Poland, two schools of thought developed when it comes to desired changes in the size structure of farms and the future of domestic agriculture. The first, known as agrarian, emphasised advantages of small family farms over manor farms, namely the large ones, including gentry farms. The enthusiasts of this school considered that small farms are supported by “the unity of action and thought” (same people take decisions and put them into effect), are more resistant to emergency situations and are better in production of laborious kinds of agricultural activity – animal production and gardening. Additionally, the agrarian trend had some national marks, as some of its representatives were convinced that small farms are the base of vital and creative forces of the society. The second trend, known as economic progress trend, critically assessed small agricultural farms, their technological backwardness and poor knowledge of their holders, which caused these farms to become a barrier in development and introduction of progress in agriculture. Hence, the agricultural policy in the inter-war period supported the formation of family farms with the size allowing to effectively use two horses and devices and machines adjusted to this type of tractive force. Of course, with the then production technology, such farms had to partially use hired labour. However, in 1939 the domestic agriculture was still dominated by small farms.

In the period of centrally controlled economy, the problem of small farms was solved after 1955 on the basis of the so-called circular migration. As a result, countless numbers of people from families having small farms commuted by trains and buses to municipal work plants to return home after having worked

a given number of hours. In this period, the meaning of income of families of farm holders coming from non-agricultural sources increased. Only in 1960-1970 the growth in the funds from this source had a decisive influence on approximately 2/3 of the total increase in the consumption level of farming population [Zegar, 2000, p. 70].

The change of economic system from command-and-control to market economy at the turn of the 1980s and 1990s, introduced significant adjustments to the conditions of management in agriculture. The deterioration of situation and growing unemployment in the national economy was of importance for small farms. As a result, families with persons who maintained their non-agricultural activities found themselves in better situation. For example, their average in the years 1993-2000 was slightly greater than the income of typically agricultural families [Zegar, 2002, p. 65].

Another important change in management started in 2002. At that time the SAPARD programme, co-financed by the European Union, started to operate. It resulted in an increase in national pool of funds for development of agriculture, the remaining part of food economy and rural areas. These funds facilitated adaptation of trades of the agricultural-food industry to the production conditions that were supposed to be met after Poland's accession to the EU. It constituted reasons for future improvement in the economic situation in agriculture.

In 2004, food economy and rural areas were covered by the EU support system and the measures intended for this purpose were many times greater than those offered under the SAPARD programme. These funds, however, were used to a various extent by particular agricultural farms. As a result, if before 2004 only ca. 25 thousand agricultural farms had characteristics indicating the competitive capacity, in the second half of the first decade of the current age there were already ca. 295 thousand farms of natural and legal persons which could be distinguished by the competitive capacity, or which were close to achieve such capacity. These were generally larger farms. This means that the vast majority of domestic farms was characterised by a small, and in parts a decreasing, business activity, which, in turn, caused a relatively large average pace of loss in their numbers – ca. 3.3% a year [Józwiak 2013, pp. 9 and 21]. A decrease was also noted in 2005-2010 in the share of families of natural persons managing farms, who obtain most of their revenue from agricultural activities they conduct, while the share of those obtaining most of their revenue from hired labour and carrying out non-agricultural activities increased [Chmielewska 2013, pp. 90-92].

The above observation was confirmed by the research of T. Wojewodziec [2010, pp. 55-65] carried out in 2007 in 262 agricultural farms of natural persons located in the Wadowice powiat in the Małopolskie Voivodeship and with the average area of ca. 3 ha of UAA. Within the area of the powiat there were approximately 11 thousand farms, ca. 50% of which had 1-2 ha, and another 40% – 2-5 ha of UAA.

Among the surveyed farms ca. 78% did not alter the UAA in the period between 2000 and 2006, ca. 6% increased the resources of this production factor leasing or buying the land, while ca. 16% sold or rented the entire land or its part. Furthermore, as at the time of research, slightly more than 31% of respondents considered lease or fallowing of land, and only ca. 10% of them declared a tendency to invest in the land.

Transfer of land to successors was often formal, not factual in its nature. It results from successors performing in person ca. 53-54% of total workload on a farm, namely ca. 39% of the time they spend on gainful employment. This let them exercise the right to agricultural social benefits – pensions, when undertaking work in the so-called informal sector. Parents or parents-in-law still worked on such farms. Beyond this, transfers of farms to successors who gave up agricultural activities were also recorded. They lent it to persons from the immediate family, leased it or sold it.

Marginal lands with unfavourable land layout or difficult access were fallowed or, at best, forested. The main reasons for limiting or giving up agricultural production were: unprofitability of production, reluctance of young people to work on the farm, problems with reconciliation of work in the farm and non-agricultural activity, as well as difficulties in selling small quantities of products.

Ca. 60% of the surveyed farms had tractors, usually well-worn, with small power. They were accompanied by horse traction equipment adapted to work with the tractor. In 2001-2006, only every seventh farm purchased any kind of machine, usually that withdrawn from use on other farms. Household buildings were rarely demolished, in spite of giving up animal husbandry, and adapted to non-agricultural purposes such as garages, storage buildings, etc. Facilities of limited cubature were occasionally built. Investments did not ensure even a simple reproduction of wearing-off fixed assets.

At the time of research ca. 13% of farms did not have livestock, while ca. 15% had poultry, and 72% had cattle and/or swine. The cattle herd was at ca. 2.2 heads, and herds of pigs and poultry flocks, accordingly, at 6.0 and 20.5

units. It shows that animal husbandry was oriented mostly at own needs of families of the holders of farms being characterised.

The share of cereals in the structure of sowings noted an upward trend. Young people, having agreed to acquire farms, re-organised production so as to decrease its labour intensity. Older persons probably acted similarly.

A landscape typical for the Wadowice powiat, with a previously widespread “chessboard of land”, was varied with small farms focused on development, which is proved by larger, dense surfaces of grown cereals of one species.

As many as 60% of the surveyed farms declared income from hired non-agricultural labour as the main source of income of their families, and 27-28% declared as such pensions of family members. Only 1% of the analysed farms were the exclusive source of income for families of their holders.

The above determinations concerning succession of farms are confirmed by the study of M. Dudek [2016, pp. 6, 9-12]. The author analysed all agricultural farms located in 84 villages throughout Poland, covered by observation under the so-called Great Survey carried out by IERiGŻ-PIB. A part of this study covered agricultural farms of natural persons. In 2000, there were 3,927 farms, and in 2005 and 2011, accordingly, 3,705 and 3,331 farms. In the last of these years the respondents were additionally asked about their plans concerning their real estate until 2000. The analysis covered the panel of farms.

It was observed that in the annual perspective the succession took place in subsequently analysed years either in one or, at the very most, in several farms, and was less frequent in small farms, namely semi-subsistence. Persons transferring farms, had a low level of general education, and farm employment absorbed the major part of time they spent on earning income. Their successors had, on average, a higher level of general education. The majority of people acquiring small and semi-subsistence farms were gainfully employed outside the acquired farm, or intended to undertake such work, and treated farming as their side business. The succession on such farms consisted thus in transferring assets, which was not accompanied by adopting activities related to running a farm.

A different situation was observed in farms larger in terms of area, with high value of commodity production, located in areas with developed agriculture. In such cases a successor had usually vocational school preparation and practical experience gained in work on a farm prior to its formal takeover.

Determinations of T. Wojewodzic stated above are also confirmed by the study of I. Augustyńska-Grzymek [2011]. The author analysed the panel of 256 small agricultural farms (2-8 ESU) covered by monitoring of the Polish FADN



in the period of 2005-2007. Average income of these farms counted per unit of working time of a farmer and members of his family was approx. 50% smaller than the parity level – the average level of labour price in the national economy. This was probably a significant cause of the fact that only ca. 46% of the holders of analysed farms had a successor.

This observation is consistent with the aforementioned unwillingness of young people to take over farms which do not ensure the accepted level of income, and in the case of takeover, successors re-organised production so as not to lose opportunities for obtaining income from other sources. The author also observed that ca. 84% of analysed farms had a negative reproduction of fixed assets with the average annual reproduction rate of these assets<sup>2</sup> at -3.3%. Ca. 16% of remaining analysed farms stand out with a positive reproduction of fixed assets.

Table 1. The level of formal professional preparation of people managing farms in the sample analysed by D. Żmija in comparison to average national data

Level of education	The share of people managing farms (%):		Differences in percentage points
	in the sample studied by D. Żmija <sup>a</sup>	national averages according to the Central Statistical Office <sup>b</sup>	
Secondary vocational	34.1	26.1	8.0
Tertiary	27.7	11.0	16.7
General secondary	6.4	6.9	- 0.5
Primary and lower secondary	7.1	14.4	-7.3
Basic vocational	24.7	38.0	-13.3
Unfinished primary and without school education	-	3.6	-3.6
Total	100.0	100.0	X

a. [2016, p. 119].

b. [Charakterystyka... 2014, p. 240].

Source: as specified in references.

Results of other studies were presented by D. Żmija [2016, pp. 113-125]. His research covered, at the beginning of 2016, agricultural farms with the area of 1-5 ha of UAA carrying out activities in the Małopolskie Voivodeship that received in 2004-2015 a direct payment and at least once received a support for investments as part of: “Rural development plan 2004-2006”, “Sectoral operational programme «Restructuring and modernisation of food sector and development of rural areas 2004-2006»” and “Rural development programme

<sup>2</sup> Relation of the net investment value to the value of fixed assets.



2007-2014". 350 of thus defined and selected farms with the use of the probabilistic techniques of sample selection received a survey questionnaire and 296 correctly completed forms, namely by ca. 11% more than the minimum sample size, was sent back.

The author is aware that a sample of agricultural farms small in terms of area selected thereby could include those which reached higher income than all farms of this kind located in the country [Żmija 2016, p. 114]. Indeed, such formulation is supported by the fact that persons managing farms covered by the sample selected by D. Żmija have expressly higher level of formal professional preparation than persons managing farms of the same size in Poland in general (Table 1). It is undoubtedly reflected in more beneficial business performance of semi-subsistence agricultural farms in the Małopolskie Voivodeship. Their average income amounted in 2015 to as much as PLN 55.5 thousand [Żmija 2015, p. 119], i.e. nearly as much as agricultural farms covered by monitoring of the Polish FADN in 2013 and having an average UAA of 23.7 ha (ca. PLN 57.4 thousand).

Farms covered by the studies of D. Żmija were thus not small, nor semi-subsistence. They were commercial medium-sized agricultural farms in spite of a small UAA. Economic effects of these farms were to a smaller extent determined by the UAA, and mainly by capital outlays, work outlays and probably also by implementation of various innovations. As a comment to this observation it may be added that in 2013 there were 3.4 thousand agricultural farms in our country owned by natural persons with UAA up to 1 ha inclusively and the production value estimated to be at least PLN 417 thousand [Charakterystyka... 2014, p. 240].

### **Applied method of analysis**

In the Chapter the size of a farm will be expressed in SO, namely in a measure commonly used in the EU Member States. It informs about the value of agricultural production calculated in a standard manner and is expressed in thousands of euros. It is the sum of the products of cultivation area of particular type and the number of animals of particular species as well as relevant individual production value coefficients. The word "standard" means that these coefficients are the average sizes for particular macro-regions of Poland.

Primary data enabling the implementation of pursued objective were mainly taken from the results of partial census of agricultural farms from 2013 since it covered all domestic agricultural farms owned by natural persons

[Charakterystyka... 2014, p. 358-371]. As a result, a rare occasion was created to take a look at the smallest agricultural farms, while it should be remembered that they cover ca. 48% of the number of domestic farms owned by natural persons.

The results of partial census of agricultural farms from 2013 contain data concerning only: the structure of income of families of their holders, crucial elements of means of production and organisation of this production [Charakterystyka... 2014, p. 17]. On the other hand, they did not contain information about amounts of income. Therefore, income, along with other necessary data, was estimated on the basis of the results of monitoring of the Polish FADN from 2013 (Table 2).

Table 2. Selected characteristics of income of different sized farms owned by natural persons in 2013

Measures and indicators	Farm size in EUR thousand of SO <sup>a</sup> :				
	0-4 <sup>b</sup>	4-15	15-25	25-50	50 and more
Farm size (EUR thousand of SO)	4.0	10.9	19.8	36.4	107.1
Income from farm (PLN thousand per farm)	7.5	14.7	28.1	57.4	172.7
Depreciation value (PLN thousand per farm)	6.0	10.7	16.6	26.2	60.3
The share of hired labour in total labour inputs (%)	14.0	17.0	20.6	26.9	45.3
Cost of hired labour (PLN/hour)	9.0	8.9	8.7	8.5	10.1

a. The production value calculated in a standard manner and expressed in thousands of euros.

b. Estimates prepared on the basis of extrapolation of figures specified in subsequent columns of the table and referring to the 4 SO size.

Source: calculations of M. Zieliński prepared on the basis of the results of monitoring of the Polish FADN and own extrapolation estimates.

Income estimates prepared on the basis of figures from Table 2 require a commentary. It was additionally determined that the so-called entrepreneurial income, largely corresponding to agricultural income and calculated nationwide as part of economic accounts for agriculture (EAA) were in 2013 explicitly larger than income agreed on the basis of the trend recorded in the period of 2008-2015. Evaluations formulated on the basis of the analysis of estimates of the income level described in this article can thus be too optimistic to be generalised for other years. Although they have a secondary meaning in relation to evaluations resulting from the results of census of 2013, the conclusions formulated in this chapter, in spite of that, cannot be treated as final.

Analysis prepared on the above basis:

- assumed that the average farm income, agreed on the basis of the results of the Polish FADN monitoring, according to size stated in SO, corresponds to the average income of likewise separated groups of farms presented in results of

partial census of 2013. Income for a size group of up to EUR 4 thousand of SO was, however, determined only for those with the size of 4 thousand SO on the basis of extrapolation of figures given in Table 1, which refer to subsequent size groups. The results of the census of 2013 do not contain figures characterising the average farm sizes in size classes expressed in SO;

- amounts of depreciation of fixed assets and labour inputs were determined using the above principles;
- estimated net total gains of farms increased by amounts of depreciation provided information about their gross income;
- the share of own labour in total labour inputs of farms was, on the other hand, calculated as the difference of total labour inputs (AWU) assumed as 100% and the percentage share in hired labour;
- own labour inputs (FWU) constitute a hundredth part of the product of ratio participation of own labour of total labour inputs expressed in AWU, calculated per full-time employee;
- net total income calculated per unit of own labour input informs about “a price” of this labour in a situation where a simple reproduction of farm takes place; but, gross income calculated per unit of own labour input informs about “a price” of own labour in a situation where farm’s assets consumed in the process are not reproduced, which results in the fast pace of their depreciation;
- net and gross income calculated per unit of labour input in the managed farm was compared to the average rate of remuneration of wage workers employed in agriculture (see Table 2) and the parity rate (the national average remuneration rate for hired labour), which in 2013 amounted to PLN 13.79 per hour [Augustyńska-Grzymek... 2014, p. 20];
- net income per unit of labour input in owned farm larger than the parity fees for own labour prove the mobilisation of profit, which is the fee for equity invested in the farm. However, the amount of profit rate was not assessed, namely its relation to the value of equity.

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

Statistics indicate (Table 3) that in 2010-2013 the number of semi-subsistence farms with size up to EUR 4 thousand of SO decreased, while the number of typical commercial farms increased<sup>3</sup>. On the other hand, from other data it can be concluded that the number of farms with the sizes of EUR 4-8

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<sup>3</sup> Presented phenomena were not new and did not affect only Poland. They take place in all countries with developing economy.

and EUR 8-15 thousand decreased. Some of them, however, adopted actions focused on joining the group of farms with the size of EUR 15-25 thousand of SO, which were successful. Almost unchanged number of farms in this latter group proves the fact that the increase in the number of farms caused by this phenomenon was balanced by transition of other farms to the group of larger commercial farms.

Table 3. Changes in the number of agricultural farms<sup>a</sup> owned by natural persons differing in size in 2010-2013

Farm size in EUR thousand of SO	Number of farms in thousands in		Changes in the number of farms:	
	2010	2013	in thousands	in %
Up to	758.2	657.5	-100.7	-13.3
4-8	273.2	260.5	-12.7	-4.6
8-15	103.8	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
Country in total/on average	1,480.2	1,391.1	-89.1	-6.0 <sup>b</sup>

a. The Table was prepared with emphasis on changes in the number of farms caused by adjusting the definition of agricultural farm in 2013.

b. Weighted average.

Source: own determinations prepared on the basis of the study [Charakterystyka... 2012, pp. 384-385] and the study [Charakterystyka... 2014, pp. 18, 75-76 and 358-359].

The analysis covered farms with the maximum size of EUR 4 thousand of SO, which were characterised by the largest pace of loss. They were presented against a background of farms with the size of EUR 25-50 thousand of SO. It is the first group of farms the number of which expressly increased in the period of 2010-2013.

#### **Agricultural holdings with the maximum size of EUR 4 thousand of SO against the background of farms with the size of EUR 25-50 thousand of SO in 2013**

Agricultural holdings with the maximum size of EUR 4 thousand SO had a minor importance for 89-90% of families of their holders (Table 3). It was caused by the fact that these families already obtained more than a half of their total income from gainful activities outside the owned farm, pensions, retirement pensions and/or from other sources. The remaining 10-11% of agricultural holdings with the maximum size of EUR 4 thousand of SO had a crucial meaning for their holders and their families since they provided them with more than a half

of total income. Families of holders of characterised farm groups obtaining most of their total income from pensions were probably living within traditional multi-generational families.

It was estimated that agricultural farms with the size of EUR 4 thousand of SO yield net income in the amount of PLN 4.3 per hour of own labour input of the farm holder and his family when it fully reproduced permanent means of production which are consumed in the production process (Table 4). This income was significantly lower (by 52.2 percentage points) from the remuneration rate of wage worker employed in agriculture and correspond to 31.2% of the parity rate.

Table 4. Number of farms, its change in 2010-2013 and structure of income of families of holders of agricultural farms owned by natural persons differing in size (situation in the period between 2 June 2012 and 1 June 2013)

Measures and indicators	Farms with the size of (EUR thousand of SO)		The difference in percentage points in relation to farms with the size of EUR 25-50 thousand of SO
	4	25-50	
Number of farms in 2013 (thousands)	657.5	107.1	x
Changes in the number of farms against 2010 (thousands)	-100.7	13.9	x
Changes in the number of farms against 2010 (%)	-13.3	14.9	x
The share of families of farm holders (%) with income:	10.6	75.3	-64.7
▪ from agricultural activities exceeding a half of total income			
▪ on account of <sup>a</sup> :	59.9	16.3	43.6
– gainful employment	36.7	17.0	19.7
– pension or retirement pension			
– running non-agricultural activities	17.4	10.2	7.2

a. The share of these sources does not total to 100.

Source: own determinations prepared on the basis of the study [Charakterystyka... 2014, pp. 18, 75-76, 358-359 and 370-371].

However, if a farm did not invest, then the gross income (income from farms increased by the depreciation amount) per hour of own labour input amounted to ca. PLN 7.8, namely to 86.7% of the remuneration rate of wage worker in agriculture and to 56.6% of the parity rate. Such a manner of farm management resulted, however, in total depreciation of fixed assets over time.

For instance, 54-55% of these farms did not have their own mechanical tractive force in 2013<sup>4</sup>. Deeper analysis of this situation can be found in the study of W. Musiał [2010, pp. 63-66].

But even in such a situation farms were able to continue production, investing own labour inputs with the use of simple tools and using inputs of purchased current and own assets (seeds; straw, secondary crops and/or manure for ploughing; feeds for livestock, etc.), and using production services.

Table 5. Estimated average net and gross income calculated per one hour of own labour inputs in the farms owned by natural persons, differing in production size and the assessment of this income (condition in 2013)

Measures and indicators	Farm size (EUR thousand of SO)	
	4 <sup>a</sup>	25-50
Income in PLN calculated per hour of own labour inputs:		
– net income	4.3	9.3
– gross income	7.8	14.7
Net income in PLN calculated per hour of own labour inputs in relation (%) to:		
– remuneration rate of agricultural worker	47.8	207.1
– parity rate	31.2	127.6
Gross income in PLN calculated per hour of own labour inputs in relation (%) to:		
– remuneration rate of agricultural worker	86.7	302.3
– parity rate	56.6	186.4

a. Income of farms of this size determined on the basis of extrapolation of numbers taken from the Polish FADN, typical of all size groups of agricultural farms.

Source: own estimates prepared with the use of the results of monitoring of the Polish FADN listed in Table 2.

It results from the above that families from the farms having no income outside the farm had very small cumulative income. The majority of farms had however, a lower value of production than those with the size of EUR 4 thousand of SO, therefore they yield a smaller income that the one listed above, which, in turn, caused families of their holders to use to a greater extent an income derived from other sources.

Incomes of parts of farms with the maximum size of EUR 4 thousand of SO did not meet ambitions of their holders and members of their families and possible successors, which most likely was a significant cause of resignation from their conduct. On the other hand, in farms with the size of EUR 25-50

<sup>4</sup> Own determinations, prepared on the basis of figures taken from the study [Charakterystyka... 2014, pp. 368-369].

thousand of SO own labour income was so large that the number of farms did not decrease but was clearly increasing.

Net income per hour of own labour input significantly exceeded the parity rate, which, in turn, ensured the accepted living conditions for holders of such farms and members of their families as well as the means enabling extended reproduction of own assets.

There was a number of reasons for achieving small income by the farms with the maximum size of EUR 4 thousand of SO as compared to farms used for comparisons, namely:

- They were characterised by ca. 43 percentage point smaller share of persons managing the farm having formal professional preparation (Table 5), which limited the effectiveness of production of smaller farms.

Table 6. The size of analysed agricultural farms expressed in SO, their land resources, formal qualifications of managing people, labour inputs and equipping in mechanical tractive force (condition as at the mid 2013)

Measures and indicators	Farms with the size of (EUR thousand of SO):		Numbers from farms with the size of EUR 25-50 thousand of SO = 100%
	up to 4	25-50	
Average farm size (SO <sup>a</sup> )	1.9 <sup>b</sup>	38.1 <sup>b</sup>	5.0
The share of managers of farms having agricultural education (%)	30.8	73.5	-42.7 <sup>c</sup>
Average UAA of the farm (ha)	2.8	23.7	11.8
Average employment in the farm per full-time employee	0.7	2.1	33.3
Share of farms with at least one tractor (%)	42.9	95.8	-52.9 <sup>c</sup>

a. Production value calculated in a standard manner, expressed in EUR thousand.

b. Size determined on the basis of estimations.

c. Difference expressed in percentage points.

Source: own determinations prepared on the basis of the study [Charakterystyka... 2014, pp. 167, 358, 360, 364 and 368].

- Labour inputs were by 2/3 smaller and resources of assets, mainly soil were considerably smaller. Lack of mechanical tractive force and most likely relevant machines in some of them was, however, justified due to limited possibilities of their profitable use. The presence of such resources in other analysed farms with the maximum size of 4 thousand SO could thus be a symptom of irrationality of actions taken by manufacturers, unless these resources were used to provide production services in other agricultural farms.

▪ More than eight times smaller resources of land in farms with the maximum size of EUR 4 thousand of SO than in farms used for comparisons was not translated into the better use of this production factor (Table 6). It is because the share in UAA of cultivation area yielding higher income from an area unit (industrial plants, vegetables, strawberries, orchards) was smaller by 8.3 percentage points (p.p.), and the share of UAA not yielding agricultural production (fallows and lands in bad “agricultural condition”) was larger by ca. 9.9 p.p.

Table 7. The structure (%) of use of UAA in farms owned by natural persons differing in size (condition as at the mid 2013)

Measures and indicators	Farms with the size of (EUR thousand of SO):		Difference in percentage points in relation to farms with the size of EUR 25-50 thousand of SO
	up to 4	25-50	
Sown area	53.9	70.5	-16.6
including:			
– cereals	46.3	49.0	-2.7
– potatoes	1.9	2.6	-0.7
– industrial plants	1.3	6.9	-5.6
– ground vegetables and strawberries	1.5	1.7	-0.2
– other sowings	2.9	10.3	-7.4
Permanent cultivations, including orchards	1.4	3.9	-2.5
Home gardens	0.8	0.1	0.7
Meadows and permanent pastures	32.8	26.9	5.9
Fallows and uncultivated lands	7.5	2.1	5.4
Other uncultivated lands	5.0	0.4	4.6
Total UAA	100.0	100.0	X

Source: Own determinations prepared on the basis of the study [Charakterystyka... 2014, pp. 364-367].

▪ The scope of use of activities increasing the acquired value added was limited, which is informed by ca. 50 percentage point larger share of farms with the maximum size of 4 thousand SO which specialised in production of plants (Table 7). The outcome of sale of raw materials of vegetable origin instead of their processing on the farm under animal production.

▪ Labour consumption of production, being a derivative of the lack of technical means of production substituting work was almost three times higher. This means that work performed with the use of simple tools was dominating in the farms with the maximum size of EUR 4 thousand of SO, and the use of services was small in scope.



▪ Share of farms using natural fertilisers of animal origin, was smaller by almost 50 percentage point which indicates that they had a small water capacity of soil and small possibilities of absorbing mineral components of necessary crops. A resulting decrease in soil fertility led to reduction in yields and their larger fluctuations in subsequent years.

Table 8. Organisation and intensity of production in agricultural farms owned by natural persons differing in size (condition as at the mid 2013)

Indexes	Farms with the size of (EUR thousand of SO):		Difference in percentage points in relation to farms with the size of EUR 25-50 thousand of SO
	up to 4	25-50	
Average share of farms with production:			
▪ specialised (%)	78.0	52.4	25.6
– including: plant	72.3	22.2	50.1
animal	5.7	30.2	-24.5
▪ multilateral	22.0	47.6	-25.8
Average employment per 1 SO (hours)	530	188	281.9 <sup>a</sup>
Average share of farms using natural fertilisers (%)	28.5	76.6	-48.1
Average share of farms using mineral fertilisers and liming of soil (%)	58.6	91.7	-33.1

a. Difference expressed as a percentage.

Source: own determinations prepared on the basis of the study [Charakterystyka... 2014, pp. 358 and 368].

▪ The share of farms using mineral fertilisers and liming of soils, namely two important factors increasing sizes of obtained plant production, was by about 33 percentage points smaller. Thus, in marginal situations a continuation took place, and perhaps also a return to semi-natural production technology constantly used in farms owned by natural persons in Poland before the 1950s.

Numeric summary of what has been written before about the use of very small UAA of farms with the maximum size of 4 thousand SO is the productivity ratio of soil measured by the amount of SO per 1 ha of UAA. It amounted to merely 42.2% of the value of similarly calculated ratio for farms used for comparisons.

### Important problems faced by semi-subsistence farms

A deepening diversity of income between the countries, progressing unfavourable changes of climate and other aspects of environment, a growing phenomenon of the so-called social exclusion connected with intensification of the right-wing attitudes within social groups, terrorism and other phenomena of negative connotations are a cause of common concern. We cannot assess the va-

lidity of this concern by treating it as only a partial and local problem. Furthermore, Poland is a country exporting agricultural and agri-food products, therefore future operation conditions of agricultural farms have to be examined in the possibly wide context. Characteristics of problems to be encountered by the analysed agricultural farms are presented in this chapter on the basis of extrapolation of two types of trends – long-term, relating to global situation, and average- and short-term, relating to the European Union and Poland as well.

### Global situation in 2025 established on the basis of extrapolation of long-term trends

This subchapter presents global situation projections in the 2025 perspective. The year 2025 will mark an end of another EU financial perspective, should this community operate at similar terms as it does so far<sup>5</sup>.

The first projection refers to the characteristics of ten most important global social and economic trends in the 20<sup>th</sup> century prepared by D. Acemoglu [2014, pp. 23-71], professor in economics at the Massachusetts Institute of Technology (MIT) in the United States. According to that author, but also others [Roth 2014, p. 179], a projection of future condition can be prepared on the basis of extrapolation of long-term trends, provided that they will take account of presumptions with regard to still non-existent consequences of examined long-term trends. The characteristics of these trends were specified below.

- A sustainable revolution in rights has lasted, as a result of ideas formulated in Europe in the Enlightenment. As their result the societies of a growing number of countries began, to a large extent, to take part in choosing their leaders and exert influence on their rule. Civil rights and freedom was obtained by poor people, women and minorities: religious, ethnic and sexual. Domestic violence between husband and wife, and parents and children disappeared, relations in workplaces became more democratic<sup>6</sup>. The majority of global societies, however, was still living under the authoritarian rule of the ones operating in the best interest of a limited number of people comprising national elites.
- The range of impact of new technologies was growing. They reached beyond the impact of the organisation of production of goods as it was in the previous age, and they were more and more intermingled in every aspect of social life, health services, nutrition, transport, communication, housework, gastronomy,

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<sup>5</sup> A vision of the development of the European Union's relations in a long-term perspective will be most likely known no sooner than at the beginning of 2018.

<sup>6</sup> See books: [Miller et al. 2014, pp. 21-289] and [Masaaki 2014, pp. 31-176].

recreation, entertainment, etc. Demand for new goods and services associated with them fostered a positive economic situation.

- The global average income per capita has increased, hindered only in the periods of recession, economic crises and wars. Expressed in US dollars and prices from 2010 the optimal size of this ratio increased 2.6 times, and the trend was close to linear.

- A growth was unequal, so a gap between incomes of citizens of rich and poor countries has increased. At the beginning of the 20<sup>th</sup> century, multiplicity of relations from the 90<sup>th</sup> to 10<sup>th</sup> centile of the amount of income of particular world countries calculated per capita amounted to less than 9 and now it is close to thirty.

- A sustainable transformation of work and earnings has lasted, consisting in limiting employment in agriculture in favour of employment in industry. In the present century employment in industry is limited, and the increasing share is recorded of people employed in the following services: education, personal hygiene, tourism, finance, etc. Professions requiring average qualifications are disappearing, which, in turn, results in the disappearance of middle class. This phenomenon, in combination with the lack of workplaces for low qualified people, caused by substitution of their work with more and more effective machines and devices, leads to polarisation of income within particular countries.

- A sustainable health revolution has lasted, which provides a growth in the average life expectancy from ca. 30 to 60 years. The reasons include improvement in the level of hygiene (clean water, sewage treatment, etc.) and prevention, which, in turn, was reflected mostly in a drop in mortality rate among infants and children. Currently, the average life extends because of the increasing share of elderly people.

- Integration of the world was continued as a result of acceleration of flow of goods and technologies beyond the boundaries. The share of foreign trade in total GDP of countries of the world amounted to ca. 22% in the early 20<sup>th</sup> century, to reach ca. 40% in 2000. This process continues in the present century. It is enabled by changes taking place in trade policy of countries, consisting in transferring production to the countries with lower wages and developing communication technologies facilitating externalisation of activities. Some countries with cheaper labour saw a decrease in the number of persons employed in agriculture, like it was recorded in the 20<sup>th</sup> century in countries now deemed economically developed. The progressive integration of the world is also referred to as globalisation.

- The first half of the 20<sup>th</sup> century was filled with extraordinary intensive struggles, while the second one was more peaceful. In the first forty five years of that

century, in the course of international military conflicts, 200 people per 100 thousand population were dying every year in battles or died of suffered wounds, while in the subsequent years this ratio dropped ca. 40-times. But in domestic wars in the period between 1912 and 1952 (end of colonial age) 16 people per 100 thousand population were dying annually, then this ratio decreased by ca. 75%. This situation, more favourable than in the first half of the century, has continued until present day.

- A tendency to limit the range of revolution in laws appeared. In the period between 1930s and the end of 1980s there were such movements as fascism and communism. They have devastated many countries and caused death of tens of millions of people. German Nazism and Italian fascism were eradicated as a result of World War II, and residues of fascism disappeared along with falling fascist regimes in Portugal, Spain, Greece and Latin America. There are still communist states, but since the end of 1980s their number has significantly reduced.

The recent fifty years revealed another counter-Enlightenment phenomenon emerged, which is regeneration of politicised Islam in the countries of Northern Africa, the Middle East and South Asia. This is perhaps a reaction of people raised in authoritarian, traditional families and communities on changes arising from culturally different western world, which are a threat for this culture. Beyond this, there is a common feeling in Islamic countries that the imperialistic West has largely contributed to poor development of countries.

- Growth in the human population continued. The world's population increased in 1900-2000 from 1.5 to 6.9 billion, i.e. 4.6 times, and only 1.7 times in the countries of Western Europe, North America, Australia and New Zealand. Along with growth in population figures and economic development, natural resources began to deplete, which led to the increase in their prices and the first symptoms of unfavourable climate changes were observed [Weitzman 2014, p. 232].

The primary causative force for technological and economic changes in the previous century outlined above were institutional improvements resulting from revolution of rights which were mentioned while characterising the first global long-term trend. Countries that underwent this revolution were dominated by economic institutions referred to as inclusive (institutions gathering people). They ensure possibilities and stimuli to the development of innovation and economic activities of maximally large part of the society. These stimuli are based on the right to personal freedom, the right of ownership and their protection. In the latter case, it is about interests of innovators, wage workers and business people.

Inclusive economic institutions must be supported by inclusive public institutions. Possibilities of the former enhance equal rules of game, e.g. the lack of barriers to entry in business or professional groups. Beyond this, it is about such centralisation of state so that representatives of governments democratically elected by citizens, rather than any military group or dictator, have a monopoly on the use of force ensuring order and safety in its area.

Countries with inclusive institutions are liberal democracies. Their duration provides the balance consisting in appreciation of interests of business people, inventors (innovators) and wage workers. The reasons for success are not only the increasing capital and work inputs, but also monopolistic pensions from produced innovations which enable to improve the effectiveness of production, substitute depleating natural resources (for example land used for agricultural purposes), as well as manufacture of new products and products unknown earlier, which stimulates the demand.

The opposite of countries of liberal democracy are countries with extractive institutions (separating people) known also as authoritarian states. They are characterised by institutions ensuring transfer of income from most of the society to narrow elites and by rules favouring these elites (e.g. barriers to entry in business and specified professions). Such conditions of management are petrified by political extractive institutions which put the power in the hands of representatives of a narrow group of interest, whose authority is not subject to control and limitations.

The stability of countries with extractive institutions ensures enforcement of any autocratic idea and rigorous compliance with the hierarchy valid under different structures: countries, cities, housing estates, villages and families, as well as workplaces. Economy in the countries organised extractively grows when they catch up with transfer of technology from countries with inclusive institutions. This growth may take even several decades, but this situation has its limits. Transfer of some kinds of production from countries with inclusive institutions to countries with extractive institutions, usually with cheap labour and small requirements related to environmental protection, leads to erosion of extractive institutions. As a result of this and due to other reasons, countries organised extractively are changing by way of a rebellion of the majority of population. This paves the way for institutions of more inclusive character, but they do not function very well from the beginning under conditions of well-established social hierarchy and traditional impact on the population of extractive socialisa-

tion system. Thus, there are democracies where individual freedom is not fully respected and which, consequently, are not fully inclusive democracies.

Changes of extractive structures to inclusive ones are an important cause of: improvement in the standard of living, increase in the human population and decrease in tragedies and damages caused by wars. An adverse side effect of this kind of development is, a growing anthropopressure on the environment, probably the most important symptom of which are unfavourable climate changes.

According to specialists, households and economy in the world are capable of saving ca. 1/3 of energy consumed nowadays, this however would not solve the problem. Thus, attempts are being made to solve it through subsequent innovations reducing production costs of the currently known, yet unconventional and still expensive methods of acquiring energy.

There are, however, factors which weaken the pace of growth in the number of countries with inclusive institutions. One of them is small stability of democratic system in the case of low level of education of the majority of citizens, since they can be easily subjected to manipulations of charismatic politicians with autocratic tendencies.

Another factor is polarisation of income in countries of liberal democracy leading to concentration of resources and incomes by a small group of people and to dissatisfaction of people unemployed or obtaining disproportionately low incomes. This situation stirs very strong emotions. Talented politicians are able to make use of such situation, which, in turn, may endanger the existing social order.

The third factor is fast and long-term pace of development of some countries with extractive institutions (recently, e.g. China). It is the cause of spread of a false view that enlightened authoritarianism better served the economic development than parliamentary democracy.

Reduction in the pace of formation of countries with inclusive institutions is also associated with the aforementioned reactivation of politicisation of religion in some areas of the world.

### Projection resulting from the generation cycle

Two history professors from the USA – N. Howe and W. Strauss [1991] noticed recurring cycles of changes in values shared by subsequent generations of people living between 1594 and 1946 on the area of the present USA. These changes have an impact on attitudes and actions undertaken by people.

Changes in attitudes and corresponding actions take place in the four-generation cycle (saeculum): high, awakening, unravelling and crisis [Strauss and Howe 2007, pp. 2-22]. In the period of dominance of high generation indi-

vidualism is depreciated and socially-oriented institutions continue to strengthen; all these events are accompanied by optimism.

In the next period (domination of awakening generation), turmoil begins to settle as a result of crash of values recently put into practice with prior social order, more individual-oriented. The period of dominance of the third generation (unravelling generation) is the time of emerging individualism and weakening of socially-oriented existing institutions.

The last period of generation cycle – the social crisis, is the time of solving turmoil existing in human awareness and time when a regime of new values quickly replaces the existing social order [Strauss and Howe 2007, p. 3]. The last stage of generation cycle, of course, should not be confused with the phase of crisis being a part of economic cycle.

The last three generation cycles lasted in the USA, on average, for ca. 80 years (with small fluctuations of duration). Generations are set apart by dominant archetypes (accordingly: hero, artist, prophet and nomad), which indicates the opinion of authors of the theory that the values shared by people are shaped mainly in the sphere of sub-consciousness. Subsequent generations are separated from one another by great emotional events of national or global importance known as turning points. Beyond this, the value system of generation is formed under the influence of family, friends, community and general social climate of times in which a given generation lives.

A generation comprises people born in approximately twenty subsequent years counting, approximately, from the birth of the first person to the birth of their first child. There are, however, several-year deviations from this rule in different countries, resulting from local events commonly affecting human emotions. Occasionally, it happens that in particularly dramatic conditions the next generation does not vary in terms of their motivations from the previous one.

In democratic countries people start to exert influence of regional and national policy by taking part in first elections in their life (they participate also by not casting a vote), take job, establish their own companies or take them over from their parents. On the other hand, in more or less twenty subsequent years they begin – together with people from the previous generation – to directly affect the economy and fate of their region and country as activists of regional administration structures and politicians at national level, organisers of various non-governmental social structures, entrepreneurs, heads of enterprises, as well as writers, visionaries, teachers, professors, experts, officers, lawyers, priests and others. The third two-decade period of generation is the time of the greatest pro-



fessional and social activity, people from this generation perform their social and economic roles along with people from the next generation and consequently retire. Later, for several to a dozen or so years, they still have an impact on the fate of its region and country by taking part in elections.

The current saeculum is ongoing since the end of World War II. People from a high generation of this cycle, born in the USA in 1901-1924, suffered in youth from the effects of severe crisis in the 1930s, and men took part in combat operations of Allies during World War II. Later, however, they initiated planning of economy and fast accumulation of material riches, and made their country a global power. This was also a time of multi-generational families, strong trade unions and a time when the majority of citizens voted for a party securing a strong position for the country [Strauss and Howe 2007, p. 17; Jarkowiec 2015].

People of the awakening generation (born in the period between 1925 and 1942) were characterised by foresight and conformist attitude, but as they got older, they started to doubt the shared values. However, only the next generation (unravelling) changed the period of complacency and optimism into a period of turbulent events resulting from passionate search for a new social agenda. In 1970-1990, the US government has still been polishing its planning, yet anti-conformism protests began to grow, family life ceased to exist, a smaller pressure was put on having material goods and savings, religion was abandoned. In 1991-2000, the US society was already strongly individualised. Americans did what they wanted to and thought that nobody has the right to intrude in their affairs.

More or less since the second half of the previous decade US citizens were witnesses of replacing the third generation under the present saeculum (unravelling generation) by the fourth generation – social crisis. Thus, an attitude dominant nowadays is individualism. Limited importance is attributed to professional ethics, a spectacular proof of which is the so-called creative accounting, which became an important cause of initiating in the USA in 2007 the present economic recession, and in some countries – even the economic crisis. Americans are hostile towards the inflow of immigrants. The country is weak. Even the United States could not prevent dramatic events of 11 September 2001. Adam Leszczyński [2016], referring to research findings of sociologists, political scientists and statisticians, informs as well that a big group of white men without a university degree lost the possibility of having a good job, which results in an increasing accumulation of debt, reduction in the number of marriages, increase in the use of drugs and intensification of suicidal tendencies. Furthermore, it adversely affected an image of “real” American commonly accepted by white men



– a strong human being, speaking his/her mind, achieving successes in professional and personal life.

The phenomena presented above raised quite a common anxiety. The solution is US citizens' consent to limit parts of their liberties to strengthen the role of the state in preventing acts of terrorism. On the other hand, men who want America to resemble what it was like until recently, have voted in November 2016 for Donald Trump – the candidate of the Republican Party.

Neille Howe and Wiliam Strauss proved that their observations formulated on the basis of American experiences refer also to countries of: Western and Central-Eastern Europe arising after the collapse of the Soviet Union, and a considerable part of Asian countries. It corresponds with the views of two German professors – Claus Leggewie and Harald Welzer [2012, pp. 159-197 and 200-202]. The authors pay attention to the fact that currently dominant human attitudes are characterized by thinking in categories of the present and private interests, which, in turn, results in the fact that the majority of people do not see increasing national and global problems.

Christian Kern – the chancellor of this country and social democrat assessed the phenomena of the characterised type occurring currently in Austria in an interview given to Bartosz T. Wieliński [2016]. According to Kern, people voting for populists are mainly persons disappointed with the pursued policy, rather than proponents of the right-wing views. This group has grown in numbers, since dissatisfied people were joined by people from middle class who are losing hope that their children will keep a social status of their parents in the face of changes in the labour market, globalisation, automation, digitalisation and other processes with similar consequences.

From the research of N. Howe and W. Strauss it can be concluded that in four previous periods of dominance of social crisis generations their country was subjected to broad reconstructions, moreover, institutions previously blooming were dismantled, the arms industry was developing and the tendency to use its products increased. Therefore, during the next dozen or so years, transformations in social and economic life of the world may take place, at least in its richer part, being significantly deeper and more extensive than those of the last half-century.

From the presented projections prepared on the basis of long-term trends it seems that development of global economy will be interrupted during the next dozen years by: accelerating unfavourable climate changes, growing material costs of production caused by more and more difficult access to natural raw ma-

terials and, first of all, intensified occurrence of individualistic human attitudes. The latter phenomenon indicates that one should expect unstable policy of states (fiscal, financial, strengthening human creativity, etc.) in order to collect funds for active social policy. Thus, there will be no conditions for developing business activities, since there will be a high risk for entrepreneurs. Hence, the share of investments in the world's GDP would probably not increase. Global recession started in 2007 may thus still last for the next dozen years.

The period of dominance of the present generation of social crisis will most likely come to an end in late 2020s and the next generation – high generation – will begin the next saeculum. Therefore, as late as in the 1930s and 1940s the pace of growth in the number of states with political and economic inclusive institutions will increase, as well as phenomena usually accompanying it. The European Union will then start to consolidate.

Furthermore, it is probable that governments of a greater number of countries will approach problems of environmental protection and social exclusion of some of their citizens in a more responsible way than currently. These are undesirable phenomena which are accompanied by currently made economic progress not only in countries with extractive institutions, but also in some countries with inclusive institutions.

### Projection arising from medium and long-term trends

Probably the most important determinant of the future situation of agricultural farms is the demand for food. It will remain unsatisfied in the perspective of 2025, which is indicated by two types of data.

According to FAO evaluations the number of malnourished people in the world decreased in 1990-2015 by about half. However, as at the last year of this period ca. 790 million people still suffered from malnutrition [Józwiak 2016 (b)]. A forecast taking into account the growth in the population's income, productivity of agriculture and possibility of achieving food surpluses indicates that in 2024 the number of malnourished people will be smaller only by ca. 1/5 and will reach ca. 630 million people. However, the global calorie intake per capita will increase by 4-5%.

The above phenomenon of increased calorie intake per capita will only partially improve the fate of malnourished people because of intensifying phenomenon of obesity. Information on this subject contains an article in The Lancet entitled "Trends in adult body-mass index in 200 countries from 1975-2014: a pooled analysis of 1698 population-based measurement studies with 19.2 million participants" [www.the lancet.... 2016]. Scientists of the School of Public

Health Imperial College of London used in studies on this subject the BMI index (Body Mass index), a body mass calculated in kilograms divided by the square of the height in meters. A BMI of 30-35 means obesity for adults, and the index of above 35 means morbid obesity.

It was stated that the number of obese people has grown from 105 million in 1975 to 641 million in 2014. A prepared projection indicated, on the other hand, that the share of obese people would in 2025 amount to roughly 1/5 of the world population, whereas in 2014 this share amounted to almost 9%. The share of morbidly obese people would reach in 2025 ca. 8% of the world population.

A global demand for food not fully satisfied in the perspective of 2025 would constitute a sign of existence of price conditions ensuring continuation of development of Polish export of agri-food products, like it was before, starting from 2003. A boom in the market for goods of this kind is, however, hampered as a result of the above decrease in budget expenses on the pro-innovation policy, as well as a result of an increase in material costs of production, higher taxes and higher interest rates of credits.

An increase in costs of veterinary treatment will also take place in agriculture, as a result of invasion of exotic animal diseases caused by global warming. The last issue is discussed in a slightly wider perspective in the further part of the sub-chapter, together with characteristics of impact of climate changes on situation of agricultural farms.

The rate of growth in prices of means of production purchased by agricultural manufacturers faster than that of prices of agricultural products was recorded for several years, in Poland since 1985. Only in 1995-2014 the prices of agricultural products increased in our country by ca. 100%, whereas prices of means of production purchased by farmers by ca. 200%. Maintenance of these tendencies will keep in check the boom for agriculture, which, in turn, keep the pressure on the growth in production concentration and implementation of innovative technology in agricultural farms.

Another set of conditions is associated with “a condition” of the European Union [Józwiak (b) 2014; Szlachta 2013, pp. 76-79; Woźniak 2013, pp. 139-144]. The united Europe was established as an effect of implementation of brilliant idea of changing not very distant history with several dozen million victims of war and totalitarianism. The EU grouping has solved the problem of food security, actions focused on restriction of unfavourable climate changes are commonly known and approved, and, in addition, a process of levelling the standard of living between poorer and wealthier countries of this group advances. The

Union, however, for more than two last decades belonged to the slowest developing areas of the world, a recession started in 2008 demonstrated that the EU mechanisms related to introduction of common currency did not prevent serious irregularities, and, in addition, recently it must solve problems related to the inflow of immigrants.

Cautiously and usually delayed actions of the EU bodies lead to concern of citizens of Member States. Not less important is an effect of interview given by G. Werhofstadt, the former Prime Minister of Belgium, currently an euro-deputy and the chairman of ALD group – Alliance of Liberals and Democrats for Europe [Stasiński 2016]. Guy Werhofstadt is convinced that the renewal of nationalism and populism is caused by the lack of activities ensuring the European Union will adapt to a new reality. After all, it has been known for a long time that the common currency (Euro) does not function very well, because of no common treasury and ministry of finance. It was a misunderstanding to establish the Schengen zone without joint control of the external boundaries of group, and, in addition, the Union still did not find a method for common prosecution of terrorism. Furthermore, the EU expenses on defence amount to 42% of the amount of the US expenses for this purpose, yet the effectiveness of defensive activities is several times smaller.

Thus, the European Union may not exist as a loose confederation based on the principle of unanimity of Member States, since it will hamper every necessary and usually difficult decision. It is thus justified, according to the politician quoted, to establish a federal Union with a true government. Afterwards the present Member States will need to choose. An associated member and only an element of common market, or full membership determined by entry into a political association in which decisions will be taken by the European Union as a whole.

Establishment of united Europe changed the previous dramatic history of the European continent, and now another great revaluation, federalism, is necessary. It will guarantee the maintenance of wealth achieved by the citizens of the EU countries and diversity. Nationalism, on the other hand, does not tolerate diversity, so their intensification would become a source of internal conflicts and conflicts between different states. Only united and, above all, federalised Europe will be able to survive in a peaceful manner in tomorrow's, most likely turbulent, world (see the second part of Annex entitled "Projections of global situations in 2025").

There are premises indicating that the above presented view concerning the issue of the EU's future is not a prevalent position nowadays. We cannot,

however, preclude that after 2020 the shape of common agricultural policy will be affected by actions undertaken by the Union trying to solve increasingly larger problems. As a result financial means meant for implementation of the state's agricultural policy in the next financial perspective can differ *in minus* from a policy implemented until 2013 and the current financial perspective (2014-2020).

Thirdly, from the beginning of the current century the intense presence of extreme phenomena was recorded in Europe: floods, hurricanes, droughts on large areas [Kundzewicz et al. 2006, pp. 169-170]. Particularly adverse phenomena in Poland are droughts. This phenomenon was noticed as early as in the inter-war period, when some began to speak and write about "steppe-formation in Wielkopolska" (*stepowienie Wielkopolski*).

According to R. Przybylak [2006, p. 43] and L. Starkel [2006, pp. 10-12] in the 20<sup>th</sup> century average air temperature in Poland increased by ca. 1°C, and the number of sunny days has been increasing since the 1960s. Both these factors accelerate evaporation of precipitation water, contributing to formation of droughts, mostly in periods of plant vegetation, and their effects are the most unfavourable for poor quality soils. About 35% of UAA in Poland have soil created from sands or gravels. Water saturation is enough for plants for about 2.5 week, and then, in the event of absence of precipitation the so-called agricultural draught takes place because crops have not enough water in soil.

The effects of the presence of droughts were evaluated by examining 1,716 farms with poor quality soils (soil valuation ratio  $\leq 0.7$ ) in 2006-2013 [Józwiak et al. 2016, p. 49]. Some of them operated in gminas where draught occurred at least seven times in the eight-year period. Income of these farms is 25.3% smaller than of farms located in other gminas. Negative effects of droughts are thus evident, and, in addition, one has to state that the presently valid system of subsidies does not level their adverse effects.

According to A. Kędziora [2005, pp. 77-87] almost entire Polish Lowland (ca. 39% of the country's area) is characterised by smaller precipitation than on the remaining areas and evaporation of approximately 80% of precipitation water. Even worse situation affects a part of the Lowland covering a part or entire voivodeships: Wielkopolskie, Kujawsko-Pomorskie, Lubuskie, Dolnośląskie and Łódzkie. More than 85% of precipitation water evaporates there and it is one of the worst ratios in Europe. Therefore, no more than 15% of this water is used in that area for economic and municipal needs, supplies underground water, or unproductively flows to the sea.

Climate changes mean also emergence of previously unknown diseases. On the global scale, animal diseases reduce the size of animal production by ca. 20% every year, as well as limit game stock. An invasion of previously unknown diseases starts to increase these losses. This hazard is larger in the areas of fragmented agriculture, since holders of small agricultural farms rarely observe the relevant sanitary standards. Only large farms commonly use preventive treatments and isolate sick animals in sufficient advance, which perfectly limits losses [Józwiak 2016 (b)].

The fourth group of conditions encountered by our agriculture is the deficiency of labour resources in the national economy gradually deepening in the perspective of the next dozen or so years caused by implementation of “Responsible Development Plan” [2016], ageing of the society [Tabela... 2015] and governmental factors constituting a sign of restoration of prior retirement age. From the study [Tabela... 2015] it can be concluded that in 2035 the number of people aged 20-60 will be by 3.8 million people smaller than in 2010. Without arguing about the numbers, we may still formulate an opinion that the loss until of people at working age until 2025 will be significant. A previous domestic practice indicates that immigration of foreigners at the productive age will be limited, so ageing of Polish society will result in outflow of people from agriculture to other departments of the national economy because – as before – they will offer remuneration higher than income from work in its own small agricultural farm or from hired labour in agriculture.

The fifth and, at the same time, the last group of conditions encountered by our agriculture in 2025 refers to applications formulated in sub-section entitled “Global situation in 2025 established on the basis of extrapolation of long-term trends”. It is about individualism, dominant currently and in the perspective of 2025. Fragmentation of agricultural farms in Poland hinders the sale of ready-made products, so farmers’ individualism will put an end to the practise of undertaking group activities, such as, for example, creation and running of the organisation of producers purchasing small batches of products and preparing larger batches of uniform raw material for companies of the food industry or for export. Intense individualism may lead to raw material import, in spite of the fact that national agricultural farms will have trade surpluses. The possibilities for the increase of export to the European Union Member States are close to exhaust, yet there is and there will most likely be possible to export food products to the countries beyond the EU, this, however, requires large batches of goods of uniform characteristics.

## **Initial proposal of solution for designated problems**

- It is appropriate to maintain contacts with managerial institutions of the European Union which will allow Poland to exercise influence on the amount of measures and their distribution as part of cohesion policy and common agricultural policy in subsequent financial perspective, in a manner ensuring implementation of the most important interests of domestic agricultural farms, inhabitants of rural areas and economy as a whole. Agriculture may still be a source of raw materials used to manufacture food products for the domestic purposes and for export.

- Further unfavourable climate changes will worsen the water balance of soils, which, in turn, will reduce already small possibilities to irrigate cultivations. It is thus necessary to prepare an Act and provide funds that will allow to reduce a useless flow of water by rivers to the sea. It is about increasing retention (stopping and storing a useless runoff of periodical excess of precipitation water). This retention can be increased by:

- appropriate fertilisation of soils used agriculturally with organic fertilisers;
- reconstruction of old and construction of new devices damming or gathering water, such as: ditches, canals, dykes, gates, sluices, weirs, holding tanks, etc.<sup>7</sup>;
- ban on using peat;
- creation of possibly the most extensive polders in the areas with abandoned agricultural production around the regulated rivers (river-canal) and flooding them through culverts by protective shafts.

Forest litter has a significant retention potential. Thus, it is necessary to ban clearing over one-hundred year old forest stands and trees in the mountain and submontane areas, and to introduce actions restoring the natural condition of forest stand for particular habitats.

Such a system – next to large deep dammed reservoirs and embanking of rivers – will provide water during draught and, at the same time, will protect the country against floods. Of course, its creation should be spread over years.

- It is appropriate to create forest strips crossing large stretches of arable fields which reduce evaporation of water precipitation (coming from rain and melted

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<sup>7</sup> This and the following information regarding devices, structures and activities increasing water retention were taken from a letter of dr hab. Romuald Kosina from the Institute of Experimental Biology of the University of Wrocław of 27.11.2015 which was sent to the secretariat of the Citizen Letters and Dialogue Office at the President of the Republic of Poland.



snow), as well as the use of dense soils (nearly  $\frac{1}{4}$  of all UAA in the country), the so-called agrimelioration that will allow to reproduce resources of underground water taken for the economic purposes to a greater extent than currently and for the purposes of households [Kędziora 2005, pp. 95-96].

- It is justified to introduce obligatory insurance of cultivations against losses resulting from extreme weather events (droughts, floods, hurricanes, hailstorms). Such insurance will reduce the amount of insurance rates paid by agricultural manufacturers and will reduce the risk related to their management.
- In connection with migration of a considerable part of farming population (mostly from small farms) to work in other sections of the national economy it will be appropriate to make an amendment of the Act on lease of land, which will increase the rights of lessees. This will reduce the costs borne by them for purchases of land and will allow to allocate funds saved in this way for purposes related to modernization of farms and thereby expanding volumes of production, to limit unit production costs.

### **Summary**

- The chapter consists of three parts: an analysis of domestic agricultural farms owned by natural persons, characteristics of major new problems which they begin to encounter in the current EU financial perspective (2014-2020) or will encounter in the next one. The third part indicates initial proposals of methods of their solution.

An analysis of situation of farms was made based on the numbers taken from results of partial census of agricultural farms of 2013. It had two advantages. The characteristics of the smallest farms was obtained (with the maximum size of 4 SO), namely those not covered by the Polish FADN monitoring and, secondly, the characteristics of general population of semi-subsistence and, at the same time, the smallest farms running agricultural activities. Such characteristics was broadened to include the amounts of income of agricultural farms as well as quotients of income and labour inputs of agricultural manufacturers and members of their families in their farms. It was done on the basis of the results of the Polish FADN monitoring.

The numbers describing income of farms and income from own labour on the farm covering one year need to be commented on. It was additionally determined that the so-called entrepreneurial income calculated nationwide under economic accounts for agriculture (EAA) were in 2013 clearly greater than income calculated on the basis of a trend observed in 2008-2015. Evaluations



formulated on the basis of the analysis of estimates of the income level described in this article can thus be too optimistic to be generalised for other years. Although they only have a secondary meaning in relation to assessments resulting from results of census of 2013, but in spite of that the conclusions formulated below should be treated as final.

- Agricultural producers in Poland transfer an agricultural farm they own to a successor, provided that there will be any. A considerable part of farms has small resources of assets and small production sizes, thus bear the name of semi-subsistence or small farms. On the other hand, they have relatively high labour force.

May successors decide in this situation that they want to be manufacturers and live with their families from income from a farm? From the presented analysis it seems that the majority decided otherwise. Instead, they actively seek and find other sources of income. It indicates that small income from the agricultural farm not only limits interest in modernisation by increasing the value of farm assets, but even running agricultural production so as to increase the production added value.

In addition, approximately 69% of managers of small farms do not have a formal professional preparation and such situation is worse by a few dozen percentage points than in comparable larger farms. It is not new to state that persons without respective qualifications have limited knowledge about what should be done in order to improve the situation of owned farm.

A problem of small farms is not only the issue of motivation of their holders and knowledge they possess, but also a problem of deficiency in free capital and possibility to make use of credit. Empirical materials used allowed to point out that a part of holders of small (semi-subsistence) agricultural farms made efforts consisting in increasing the value of their assets. However, data were missing allowing to: determine the share of such farms in the examined sample, specify their characteristics and determine consequences of this phenomenon.

- Similar phenomena, though smaller in intensity, had also taken place in farms with the size of 4-15 SO. Altogether, nationwide, the issue taken up in this chapter related to approximately 1,100 thousand agricultural farms (with the maximum size of 4, 4-8 and 4-15 SO), namely 77.2% of all which were owned by natural persons. Their number decreased in 2010-2013 by 10.2%.

An additional analysis demonstrated that 77.6% of farms with the maximum size of 15 SO provided only additional measures used to maintain the standard of living for its owners and their families. They obtained most of their income from: gainful employment beyond the farm, pensions and retirement pensions and from running non-agricultural business.

It was estimated that unit net income from work on farms with the maximum size of 15 SO was on average smaller by at least 34.9% than the rates of pay of wage workers in agriculture and by 57.9% lower than the parity rate. Thus, simple reproduction of owned production assets significantly lowered the standard of living of holders of such farms and their families. A solution was to abandon simple reproduction of production assets, since gross income was slightly greater than the rate of pay of agricultural worker, but still at least by 34% smaller than the parity rate. Of course, a solution was found in income from other sources.

The remaining part of families of holders of farms with the maximum size of 15 SO (22.4%, that is 319.3 thousand) obtained less than a half of their total income from sources other than running agricultural production. These families had thus a very low standard of living.

- Families with farms of the analysed size and incomes from pensions and retirement pensions were multi-generational. A share of farms with incomes from retirement pensions suggests a traditional approach of this group of population to the organisation of family life. Empirical materials used in this chapter did not allowed to determine whether this phenomenon positively correlated with using traditional (non-modern) technologies in the production process.
- A boom for agricultural products limited in 2025, uncertainty as to the conditions of crediting and taxation, climate changes unfavourable for agricultural production, smaller supply of innovative technologies, subsidies smaller than currently and difficulties in selling small quantities of raw material will have a limited relevance for semi-subsistence (small) farms, which derive most of their income from gainful employment beyond the farm. It will be possible to compensate a decrease in income due to these reasons by a greater possibility to find a job beyond agriculture favourable in terms of income. An increase in the number of workplaces and in remuneration will additionally encourage a greater number of farm holders to abandon agricultural production.

A different situation will be observed in 2025 in the case of other small (semi-subsistence) agricultural farms, not investing or investing to a small extent. Greater than now possibility to find paid work and growth in remunerations

in the national economy will result in holders being interested in gaining income outside an owned farm, and, consequently, to resign from more laborious kinds of production and limit income derived from the agricultural farm.

It is also necessary to consider a limitation, as compared to the present situation, in the number of small (semi-subsistence) farms, which will take the risk related to investments generating as a result “a promotion” to a group of larger farms and commercial farms.

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# AGRICULTURAL FARMS FROM THE LFA AS COMPARED TO OTHER FARMS

## Introduction

In Poland, as the less-favoured areas (LFA) were classified approximately 56.5% of utilised agricultural areas (UAA), including 92.6% to the lowland area I and II, 5.3% to the area with specific handicaps and 2.1% to the mountain area<sup>8,9,10</sup>. Conducting agricultural production in these areas is difficult, due to unfavourable natural and social conditions. They include low quality of soils, unfavourable climatic conditions and unfavorable terrain as well as the threat of rural areas depopulation.

In general, the agricultural farms from the LFA obtain worse economic results and have smaller development possibilities than other farms located in more favoured areas. The previous studies concerning the above issue indicated however, that farms from the LFA are able to obtain comparable or better economic results and often have greater development possibilities as compared to farms from outside the LFA<sup>11,12,13,14</sup>. However, due to a relatively short analysis period these determinations should be verified, this time using a longer analysis period.

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<sup>8</sup> The LFA include rural areas in gminas and geodetic regions which were indicated in the appendix to the Regulation of the Minister of Agriculture and Rural Development of 11 March 2009 on detailed conditions and procedure of granting financial aid under the action entitled “Support of management in mountain areas and in less-favoured areas (LFA)”, covered by the *Rural Development Programme for 2007-2013* [Journal of Laws No. 40, item 329].

<sup>9</sup> According to the Regulation of the European Parliament and of the European Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing the Regulation of the Council (EC) no. 1698/2005 and the guidelines of the European Commission included in the document entitled *Fine-tuning in areas facing significant natural and specific constraints*, the Ministry of Agriculture and Rural Development, the Institute of Soil Science and Plant Cultivation – State Research Institute and the Institute of Agricultural and Food Economics – National Research Institute are conducting works for the purpose of determination of a new delimitation of the LFA in Poland [OJ EU No. 1305/2013, KE 2014, Niewęglowska et al. 2014, Pomianek 2015].

<sup>10</sup> *Rural Development Programme for 2007-2013*, Ministry of Agriculture and Rural Development, Warsaw 2016.

<sup>11</sup> Juźwiak J., *Gospodarstwa rolne na terenach ONW*, Zagadnienia Ekonomiki Rolnej, nr 3, Warsaw 2007.

<sup>12</sup> Niewęglowska G., *Stan obecny płatności kompensacyjnych ONW w Polsce*. In a paper ed. by Grażyna Niewęglowska, *Obszary o niekorzystnym gospodarowaniu w rolnictwie*, IERiGŻ-PIB, Program Wieloletni 2005-2009, nr 95, Warsaw 2008.

<sup>13</sup> Sobierajewska J., *Efektywność funkcjonowania i sytuacja ekonomiczna gospodarstw rolnych położonych na terenach ONW*. In a paper ed. by Wojciech Józwiak, *Efektywność funkcjonowania, aktywność inwestycyjna i zdolność konkurencyjna polskich gospodarstw rolnych osób fizycznych*, IERiGŻ-PIB, Program Wieloletni 2005-2009, nr 108, Warsaw 2008.

The purpose of the chapter is the assessment of agricultural farms from all categories of the LFA as compared to other farms which continuously conducted accounting for the Polish FADN in 2006-2014. Therefore, the farms from the LFA were divided into farms from the LFA lowland areas I, II, with specific handicaps and mountain areas. An advantage of this study is an additional analysis of the farms from the LFA particularly affected by an agricultural drought<sup>15</sup>. It will enable determining how large of a hazard for operational efficiency of the farms from the LFA are agricultural draughts occurring more frequently in Poland.

### Method

The analysis uses data from 1,817 farms from the LFA and 1,770 other farms which continuously conducted accounting for the Polish FADN in 2006-2014. Subsequently, the group of farms from the LFA areas was divided into five subgroups of farms differing in the category of the LFA and their operation assessment was made as compared to other farms. The first and the second subgroup of the farms from the LFA consisted of 1,277 farms from the LFA lowland areas I and 382 farms from the LFA lowland areas II, respectively. Then, the third and fourth subgroup consisted of 70 farms from the LFA with specific handicaps and 28 farms from the LFA mountain areas, respectively. The fifth subgroup is, however, comprised of 60 farms from the LFA particularly affected by an agricultural drought.

As farms from the LFA lowland areas I, II, with specific handicaps and mountain areas were deemed the farms, where more than a half of UAA was located in gminas and geodetic regions included in the appendix to the Regulation of the Minister of Agriculture and Rural Development of 11 March 2009 on detailed conditions and procedure of granting financial aid under the action entitled “Support of management in mountain areas and in less-favoured areas (LFA)” covered by the *Rural Development Programme for 2007-2013* [Journal of Laws No. 40, item 329]<sup>16</sup>. On the other hand, as farms from the LFA particularly affected by an agricultural drought were recognized the farms which were additionally located in gminas in which, under the Agricultural Drought Moni-

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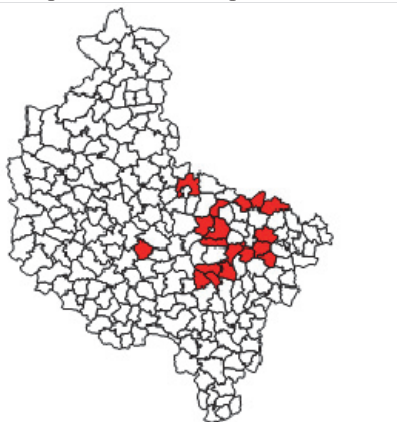
<sup>14</sup> Józwiak W., *Polskie gospodarstwa rolnicze w pierwszych latach członkostwa – kwestie efektywności i konkurencyjności*, IERiGŻ-PIB, Program Wieloletni 2005-2009, nr 181, Warsaw 2010.

<sup>15</sup> According to the definition specified in the Act on insurance of agricultural cultivations and farm animals, the agricultural drought is deemed as damages caused by occurrence of, in any six-decade period, from 1 April until 30 September the decrease in the climate water balance below the critical value specified for particular species of cultivated plants and types of soils [MRiRW 2005].

<sup>16</sup> According to the methodology of the Polish FADN.


toring System (SMSR) conducted since 2006 by the Institute of Soil Science and Plant Cultivation – State Research Institute (IUNG–PIB) in Puławy by the order of the Ministry of Agriculture and Rural Development (MRiRW), the phenomenon of agricultural draught occurred for at least one species or group of crop plants and in at least one of 13 six-decade periods of plant vegetation, in not less than eight of nine years covered by the analysis. In 2006-2014, such gminas were observed in Wielkopolskie and Kujawsko-Pomorskie voivodships. In Wielkopolskie voivodship there were 18 (8.7% of all urban – rural and rural gminas in the voivodship), while in Kujawsko-Pomorskie voivodship – 2 (1.6%) (Maps 1-2).

Map 1. Gminas from the LFA particularly affected by an agricultural drought in the Wielkopolskie voivodship in 2006-2014



Map 2. Gminas from the LFA particularly affected by an agricultural drought in the Kujawsko-Pomorskie voivodship in 2006-2014



 Gminas from the LFA areas particularly affected by an agricultural drought in 2006 – 2014

Source: own study on the basis of SMSR in 2006-2014.

The comparative evaluation of agricultural farms from LFA and other farms primarily concerned their equity profitability rate and coefficient of technical efficiency.

The equity profitability rate was defined as relation between profit from equity and the value of this capital. On the other hand, profit from equity was determined as the difference between total revenue and total costs increased by formally calculated own labour costs of farmers and members of their families. The cost of own labour was adopted on the basis of an average level of remuneration.

neration in the national economy in 2006-2014. In the studied period, the remuneration amounted to 11.6 PLN/hrs<sup>17</sup>.

The technical efficiency coefficient was determined on the basis of the parametric method of Stochastic Frontier Analysis (SFA). This result-oriented coefficient was determined as the quotient of actual effect with possible to be achieved desired effect which could be achieved by the farm with an unchanged level of the outlays incurred (equation 1).

$$TE_i = \frac{Y_{empiryczny}}{Y_{graniczny}} = \frac{\exp(x_i \beta_i + v_i - u_i)}{\exp(x_i \beta_i + v_i)} = \exp(-u_i) \quad (1)$$

where:

- $TE_i$  – technical efficiency coefficient of  $i^{\text{th}}$  – this farm,
- $Y_{empiryczny}$  – size of empirical effect of  $i^{\text{th}}$  – this farm,
- $Y_{graniczny}$  – size of border effect of  $i^{\text{th}}$  – this farm,
- $X_i$  – the vector of costs for  $i^{\text{th}}$  – this farm,
- $B_i$  – the vector of estimated regression parameters,
- $v_i$  – random component referring to the so-called information hype,
- $u_i$  – positive random component referring to the technical inefficiency.

The total revenues (PLN) were adopted as the category of effect for construction of the model with the use of the SFA method, while in the categories of outlays: the own and hired labour outlays expressed in AWU, the value of utilised agricultural areas (PLN), fixed assets outlays expressed in depreciation (PLN) and total costs decreased by depreciation and remuneration (PLN). The

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<sup>17</sup> Augustyńska-Grzymek I., Cholewa M., Skarżyńska A., Ziętek I., Dziwulski M., *Produkcja, koszty i dochody wybranych produktów rolniczych w latach 2006-2007*. IERiGŻ-PIB, Warsaw 2008; Augustyńska-Grzymek I., Cholewa M., Dziwulski M., Ziętek I., *Produkcja, koszty i dochody wybranych produktów rolniczych w latach 2007-2008*. IERiGŻ-PIB, Warsaw 2009; Augustyńska-Grzymek I., Cholewa M., Dziwulski M., *Produkcja, koszty i dochody z wybranych produktów rolniczych w latach 2008-2009*. IERiGŻ-PIB, Warsaw 2010; Augustyńska-Grzymek I., Cholewa M., Jabłoński K., Żekało M., *Produkcja, koszty i dochody z wybranych produktów rolniczych w latach 2009-2010*, IERiGŻ-PIB, Warsaw 2011; Abramczuk Ł., Augustyńska-Grzymek I., Czulowska M., Jabłoński K., Żekało M., *Produkcja, koszty i dochody z wybranych produktów rolniczych w latach 2010-2011*, IERiGŻ-PIB, Warsaw 2012; Abramczuk Ł., Augustyńska-Grzymek I., Czulowska M., Jabłoński K., Żekało M., *Produkcja, koszty i dochody z wybranych produktów rolniczych w latach 2011-2012*, IERiGŻ-PIB, Warsaw 2013; Abramczuk Ł., Augustyńska-Grzymek I., Czulowska M., Jabłoński K., Żekało M., *Produkcja, koszty i dochody z wybranych produktów rolniczych w latach 2012-2013*, IERiGŻ-PIB, Warsaw 2014; Abramczuk Ł., Augustyńska-Grzymek I., Czulowska M., Jabłoński K., Żekało M., *Produkcja, koszty i dochody z wybranych produktów rolniczych w latach 2013-2014*, IERiGŻ-PIB, Warsaw 2015.

form of the Cobb–Douglas production function was used for which was obtained the importance of all parameters of equation and positive verification of the model with the Likelihood Ratio (LR) test.

Due to the fact that the equity profitability rate and the technical efficiency coefficient do not express production potential, production organization, production factors productivity, income and investment possibilities of agricultural farms, therefore, in the comparative evaluation of agricultural farms from LFA areas and other farms it was decided to consider additional measures and indicators. As a result, the analysis also included their:

- 1) production potential,
  - surface of UAA expressed in ha consisting of: the owned land, the land leased for one year or longer, the used land on the basis of share in the set with the owner, as well as fallows and set asides,
  - soil valuation ratio of owned soils (pts),
  - total labour expenditures for 1 ha of UAA, including total outlays of human work as part of operational activities of a farm specified in hrs<sup>18</sup>,
  - share of managers with agricultural education (%)<sup>19</sup>,
  - average capital value (PLN thousand),
- 2) production organization,
  - share of arable land (ArL) in utilise agricultural areas (UAA) (%),
  - share of cereals in ArL (%),
  - share of green fertilizers in ArL (%),
  - share of farms not using calcium fertilizers in the period covered by the analysis (%),
  - livestock density expressed in animals per 1 ha of ArL (LU/ha of ArL),
- 3) productivity, economic efficiency and investment possibilities,
  - land productivity (PLN/ha of UAA) determined as relation of total production value of the farm to the surface of UAA,
  - capital productivity (%) determined as relation of total production value of the farm to the average capital value,
  - work efficiency (PLN/AWU) determined as relation of the total production value to the number of people employed full time,
  - income from a farm per 1 ha of UAA (PLN thousand)<sup>20a</sup>,

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<sup>18</sup> According to the methodology of the Polish FADN, until 2010 one unit of labour expressed in AWU (FWU) equaled 2200 work hours, while since 2011 it is the equivalent of 2120 work hours [Polish FADN 2011, 2012 and 2014].

<sup>19</sup> It was assumed that agricultural education of the farm manager includes basic, secondary or tertiary agricultural education.

- income from a farm per 1 ha of UAA without subsidies under operation on the LFA (compensating subsidies) (PLN thousand)<sup>13b</sup>,
- fixed assets reproduction rate (%) determined as a net investment relation to the fixed assets value including agricultural land, farm buildings, forest plantings and machines and devices, as well as animals for breeding,

The analysis rejected the extreme farm (influential). The *Statistica 12* software was used for rejection of this type of farms. As the extreme farms were deemed those which in terms of the analysed variable were different by more than three standard deviations from its average value for the particular sub-groups of farms<sup>21</sup>. This situation concerned, first of all, farms with granivorous animal husbandry, permanent and horticultural crops with particularly intensive organization of agricultural production.

### Structure of farms from the LFA and other farms

In the farms from LFA and other farms the distribution was made of percentage structure of farms with economic size up to EUR 25 thousand and above EUR 25 thousand of Standard Output (SO)<sup>22</sup>. In farms from the LFA lowland areas I and other farms the distribution of percentage structure of farms with economic size up to EUR 25 thousand and above EUR 25 thousand SO was nearly identical (Figure 1). In both cases a more significant group in the specification were farms of economic size above EUR 25 thousand of SO which constituted 69.8% and 69.6% of households, respectively. On the other hand, this group was less significant in farms from the LFA lowland areas II and those par-

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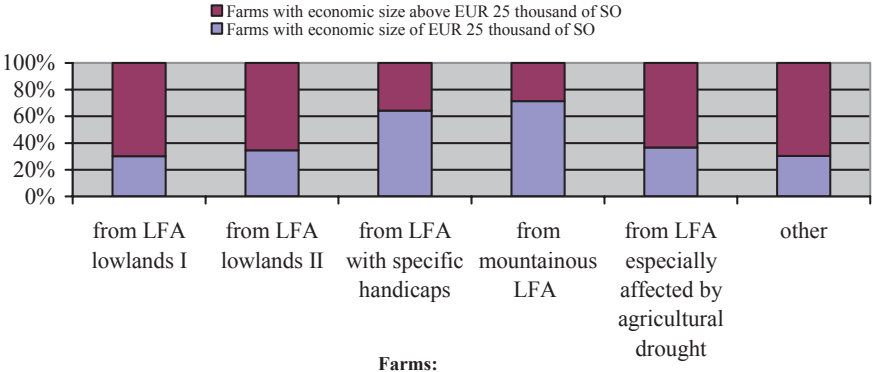
<sup>20a</sup> and <sup>13b</sup> Taking into account the importance of subsidies under operation in the LFA on levelling the income of farms from the LFA and other farms, in the analysis it was determined whether these farms in terms of the income on 1 ha of UAA and the income on 1 ha of UAA without the compensatory subsidies have any statistically significant differences between them. In order to examine the significance of differences the nonparametric U Mann – Whitney test was used or parametric tests of importance of two averages: the t test – the Student test or the Cochran–Cox test. The nonparametric U Mann–Whitney test was used in a situation when the distribution of compared variables was significantly different from the normal distribution (the Shapiro–Wilk test for  $p < \alpha = 0.05$ ). On the other hand, the parametric tests of importance of two averages: the t test – the Student test or the Cochran–Cox test in the case when the distribution had some characteristics of the normal distribution (the Shapiro–Wilk test for  $p > \alpha = 0.05$ ) [Stanisz 2007a, 2007b].

<sup>21</sup> Rabiej M., 2012. *Statystyka z programem Statistica*, Wydawnictwo Helion, Gliwice 2012.

<sup>22</sup> On the basis of the Polish FADN, the farms with economic size up to EUR 25 thousand of SO included very small farms – with economic volume of EUR 4-8 thousand and small worth EUR 8-25 thousand of SO. On the other hand, the farms with economic size above EUR 25 thousand of SO, the farms medium-small worth EUR 25-50 thousand, medium-large worth EUR 50-100 thousand, large worth EUR 100-500 thousand and very large with the value equal to or greater than EUR 500 thousand of SO [Polish FADN 2014]

ticularly affected by an agricultural drought, where their share amounted to 65.4% and 63.3%, respectively. Definitely different distribution of percentage structure of farms by economic size was observed in farms from the LFA with specific handicaps and mountain areas, where the share of farms with economic size above EUR 25 thousand of SO amounted to 35.7% and 28.6%, respectively.

Figure 1. Distribution of percentage structure of the farms from LFA and other farms in 2006-2014 by economic size (SO)



Source: prepared by the author on the basis of data from the Polish FADN from 2006-2014.

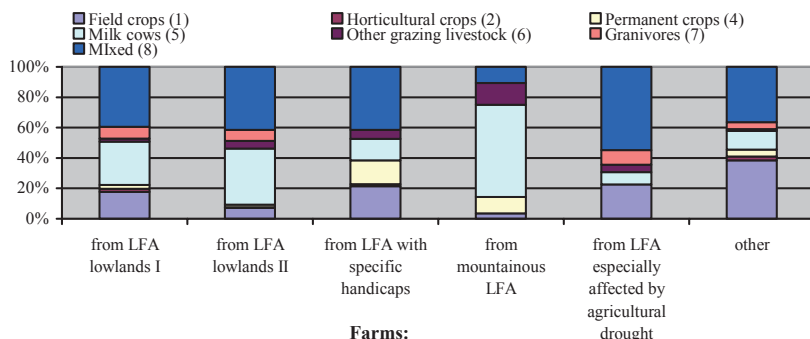
Distribution of percentage structure of the basic agricultural types (TF8) in farms from the LFA and other farms was different (Figure 2). Farms from the LFA as compared to other farms clearly had smaller share of farms with plant production<sup>23</sup>, and bigger with animal production<sup>24</sup>. In four subgroups of the farms from the LFA, the share of farms with multipartite production was also bigger.

<sup>23</sup> In total, farms with field, horticultural and permanent crops.

<sup>24</sup> In total, farms with dairy cows rearing, other herbivorous and granivorous animals.



Figure 2. Distribution of percentage structure of the farms from LFA areas and other farms in 2006-2014 by basic agricultural type (TF8)



Source: as specified in Figure 1.

### Assessment of operation of the farms from LFA as compared to other farms

On the basis of numbers included in Figure 3 it may be concluded that investment of free financial resources in operation of farms was purposeful only in farms from the LFA lowland areas I and other farms. In these farms the equity profitability rate amounted to 5.1 and 5.4%, respectively, and was higher than treasury bonds interest (on average 3.1% in 2006-2014)<sup>25</sup>. In this aspect worse situation concerned farms from the LFA lowland areas II and those particularly affected by an agricultural drought in which the equity profitability rate amounted to 2.2 and 1.9% respectively and was lower than treasury bonds interest. Definitely, the worst situation in this aspect concerned the farms from the LFA with specific handicaps and mountain areas. In these farms the equity profitability rate was negative and amounted to -1.2% and -3.3%, respectively.

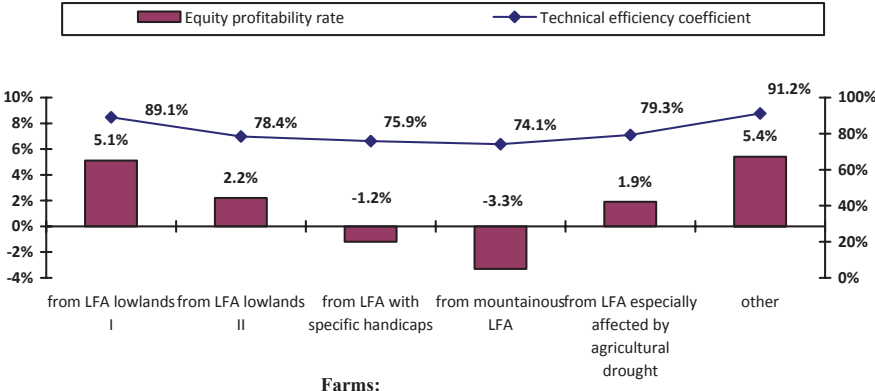
Moreover, the values from Figure 3 indicate that rather than other farms, the farms from the LFA used the held outlays in the manner less technically effective in order to produce a potential production value. Among the farms from the LFA, the highest technical efficiency was obtained by the farms from the LFA lowland areas I (89.1%), then the farms from the LFA particularly affected by an agricultural drought (79.3%), lowland II (78.4%), with specific handicaps (75.9%) and mountain areas (74.1%). On the other hand, the technical efficiency of other farms amounted to 91.2%.

<sup>25</sup> The analysis included the average net 2 – year interest of treasury bonds with annual interests capitalization in 2006-2014 [www.obligacjeskarbowe.pl].



(75.9%) and mountain areas (74.1%). On the other hand, the technical efficiency of other farms amounted to 91.2%.

Figure 3. The equity profitability rate (%) and the technical efficiency coefficient (%) in farms from the LFA and other farms in 2006-2014



Source: as specified in Figure 1.

In the farms from the LFA and other farms, the diversity of the equity profitability rate and the technical efficiency coefficient is determined by several reasons which in the first place should be sought in the differing availability of basic production factors.

In the agricultural farm, one of the fundamental production factors is area of UAA. The values specified in Table 1 indicate that the farms from the LFA lowland I areas had on average by 1.8% bigger surface of UAA as compared to other farms. Different situation concerned the farms from the remaining LFA. Here the farms from LFA clearly had smaller area of UAA from 13.2% in the case of farms from the LFA lowland areas II to 35.7% in the case of farms from the LFA mountain areas, as compared to other farms. However, it is worth emphasizing that average area of UAA of the analysed farms from the LFA lowland areas I, II, with specific handicaps and mountain areas was much greater than their national average<sup>26</sup>.

Farms from the LFA had, as compared to other farms, lower quality of the available soil (Table 1). In farms from the LFA lowland areas I and with specific handicaps the soil valuation ratio of owned soils was by 36.4% lower than the soil valuation ratio of soils in other farms. In the farms from LFA lowland areas

<sup>26</sup> Resolution No. 80 of the Monitoring Committee for the Rural Development Programme for 2007-2013 of 20.06.2013 approving the annual report from the implementation of the Programme in 2012.

II and those particularly affected by an agricultural drought it was lower by 45.5%, and in farms from the LFA mountain areas by 63.6%.

The main factor indicating the production potential of a farm are also labour outlays. In the farms from LFA lowland areas I labour outlays per 1 ha of UAA were by 2.2% lower than in other farms (Table 1). At the same time, they had almost identical average capital value. On the other hand, in farms from the remaining LFA labour outlays per 1 ha of UAA were higher than in other farms. In the farms from LFA lowland areas II and those particularly affected by an agricultural drought they were adequately higher by 12.9% and 15.1%, while in the farms from LFA with specific handicaps and mountain areas, respectively, by 33.2% and 44.5%. In the farms from LFA lowland areas II, especially affected by an agricultural drought, with specific handicaps and mountain areas the basic cause of larger labour outlays per 1 ha of UAA was lower average capital value (Table 1).

The best situation in terms of education of the farm manager concerned the farms from the LFA areas particularly affected by an agricultural drought (Table 1) in which 67.7% of managers had agricultural education. Next, were other farms, where share of managers with agricultural education amounted to 63.4%. On the other hand, in farms from the LFA lowland areas I, II, with specific handicaps and mountain areas their share varied from 41.4% to 56.7%.

Table 1. The production potential of farms from the LFA and other farms in 2006-2014

Variable	Unit.	Farms:					
		from LFA lowlands I	from LFA lowlands II	from LFA with specific handicaps	from mountainous LFA	from LFA especially affected by agricultural drought	other
Utilised agricultural areas	ha	33.1	28.2	22.2	20.9	22.4	32.5
Soil valuation ratio of owned soils	item	0.7	0.6	0.7	0.4	0.6	1.1
Total labour expenditures for 1 ha of UAA	at	126.3	145.8	171.9	186.6	148.6	129.1
Share of managers with agricultural education	%	56.7	55.7	53.2	41.4	67.7	63.4
Average capital value	PLN thousands	496.9	429.2	338.0	250.4	352.3	498.0

Source: as specified in Figure 1.

Analysis of production organization indicates presence of differences between farms from the LFA and other farms (Table 2). In the farms from the LFA, ArL were less important in UAA than in other farms. At the same time, the farms from the LFA recorded greater share of cereals within the structure of

ArL. Worrying situation in this aspect occurred in the farms from the LFA particularly affected by an agricultural drought, where share of cereals in ArL exceed their acceptable share (75%)<sup>27</sup>.

In the farms from the LFA and other, crops of green fertilizers for ploughing and a relatively high livestock density per 1 ha of ArL, made an important contribution to maintenance of positive balance of organic matter in the soil, but they were not the only important factor (Table 2). It should be added that in those farms the use of calcium fertilizers was also important from the point of view of maintenance of positive balance of organic matter in the soil. In the period covered by the analysis, the farms from LFA and other farms, there were however, agricultural farms that applied this kind of fertilizers. In the farms from the LFA the share of farms not using calcium fertilizers in the overall number of farms amounted from 25.0% to 75.0%. On the other hand, in other farms the share of such farms amounted to 24.4%.

Table 2. Organization of production of the farms from the LFA and other farms in 2006-2014

Variable	Unit.	Farms:					
		from LFA lowlands I	from LFA lowlands II	from LFA with specific handicaps	from mountainous LFA	from LFA especially affected by agricultural drought	other
Share ArL in UAA	%	78.8	72.0	62.1	34.1	81.2	87.1
Share of cereals in ArL	%	72.5	72.8	66.8	69.8	81.2	64.9
Share of green fertilizers in ArL	%	12.8	11.7	10.4	7.7	13.1	11.4
Livestock density per 1 ha ArL	LU	1.2	1.2	0.8	1.1	1.0	1.1
Share of farms not using calcium fertilizers <sup>1</sup>	%	25.0	46.1	47.2	75.0	38.8	24.4

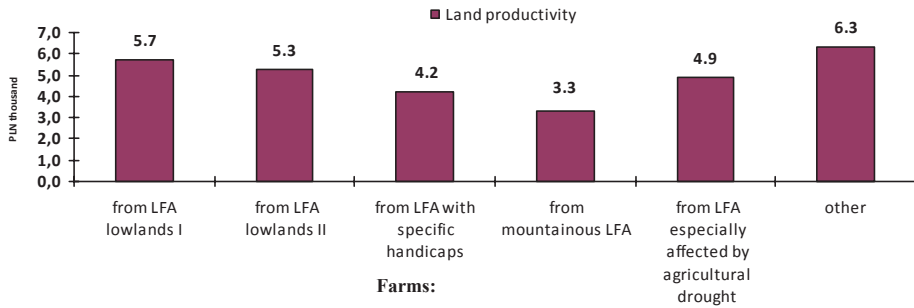
<sup>1</sup> These farms did not apply calcium fertilizers in any of nine years covered by the analysis.

Source: as specified in Figure 1.

Moreover, the farms from the LFA and other farms differed in the level of productivity of basic production factors. It turned out that the farms from the LFA had lower production factors productivity. In these farms, production value of 1 ha of UAA was lower than 9.5% up to 47.6%, the production value per PLN 1 of capital value from 5.4 to 15.9 p.p. and the value of production per 1 AWU from 7.4% to 63.8%. These differences to the disadvantage of the farms from the LFA were the lowest among the farms from the LFA lowland areas I, while the largest among the farms from the LFA mountain areas (Figures 4, 5 and 6).

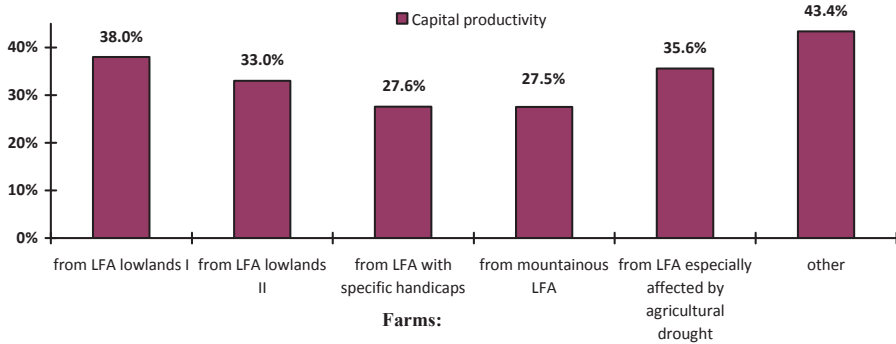
<sup>27</sup> According to A. Harasima [Harasim 2006], acceptable share of cereals in the structure of sowings amounts to 75%.

Figure 4. The land productivity (PLN thousand) of the farms from the LFA and other farms in 2006-2014



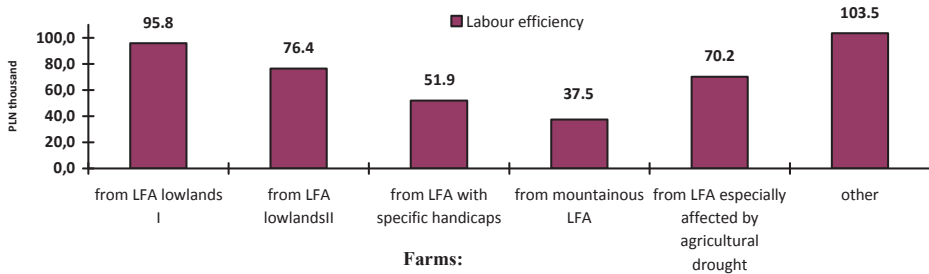
Source: as specified in Figure 1.

Figure 5. Capital productivity (%) of the farms from the LFA and other farms in 2006-2014



Source: as specified in Figure 1.

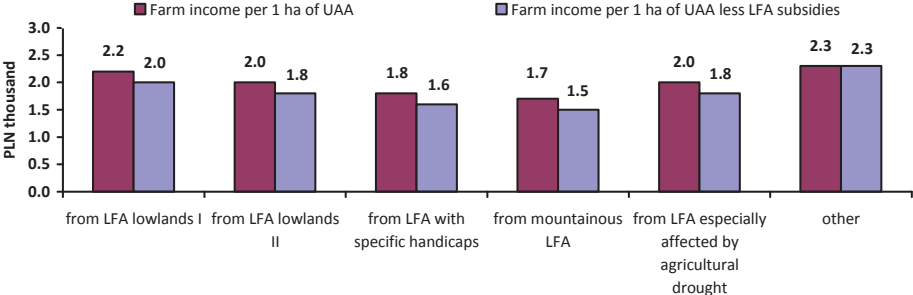
Figure 6. Labour efficiency (PLN thousand) of the farms from the LFA and other farms in 2006-2014



Source: as specified in Figure 1.

Also, there were visible differences in the income per 1 ha of UAA to the disadvantage of the farms from the LFA (Figure 7). Nonetheless, subsidies under operation on the LFA (compensating subsidies) reduced these differences. In the farms from the LFA lowland areas I as compared to other farms, the income from 1 ha of UAA was lower by 4.3%, although the difference was not statistically important. The worst situation in this aspect concerned farms from the remaining LFA areas. In these farms the income per 1 ha of UAA was substantially lower by 13.0% to 26.1%. Without the compensating subsidies, however, these differences to the disadvantage of the farms from the LFA would be larger and would amount to from 13.0% to 34.8%. What is more, all of them would turn out to be statistically significant.

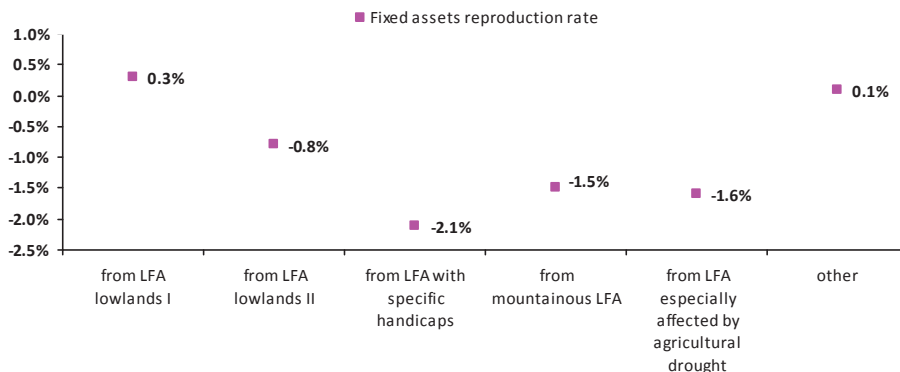
Figure 7. Income from a farm per 1 ha of UAA (PLN thousand) and per 1 ha of UAA without LFA subsidies (PLN thousand) of farms from LFA and other farms in 2006-2014



Source: as specified in Figure 1.

In four subgroups of the farms from the LFA, it was possible to observe a negative rate of fixed assets reproduction (Figure 8). This unfavourable situation occurred in the farms from the LFA lowland areas II, especially affected by agricultural drought, with specific handicaps and mountain areas. On the other hand, a reverse situation in this aspect concerned the farms from the LFA lowland areas I which just like other farms had a positive fixed assets reproduction rate. What is more, in those farms the scale of the investment on purchase of new fixed assets was higher than in other farms.

Figure 8. The fixed assets reproduction rate (%) of the farms from LFA and other farms in 2006-2014



Source: as specified in Figure 1.

### Summary and conclusions

This chapter contains an assessment of operation of farms from five categories of the LFA as compared to other farms. For this purpose a comparative analysis covered 1,277 of the farms from the LFA lowland areas I, 382 farms from the LFA lowland areas II, 70 farms from the LFA with specific handicaps, 28 farms from the LFA mountain areas, 60 farms from the LFA particularly affected by agricultural drought and 1,770 other farms which continuously conducted accounting for the Polish FADN in 2006-2014. According to Regulation of the Minister of Agriculture and Rural Development of 11 March 2009 on detailed conditions and procedure of granting financial aid under the action entitled “Support of management in mountain areas and in less-favoured areas (LFA)” covered by the *Rural Development Programme for 2007-2013* categories of the LFA include LFA lowlands I and II, LFA with specific handicaps and mountain areas. However, this analysis also includes the category of the LFA particularly affected by agricultural drought. The premise for separation of the additional category of the LFA was the author’s opinion that especially in the light soils with low water capacity, an additional hazard for operational efficiency of agricultural farms are agricultural draughts occurring more frequently in Poland. The comparative analysis primarily concerned their equity profitability rate and coefficient of technical efficiency. This was followed by a determination of their production potential, production organization, production results, productivity of basic production factors, income per 1 ha of UAA and investment possibilities.

The determinations made on the basis of the conducted analysis enable drawing the following conclusions:

- Farms from the LFA lowland areas I as compared to other farms are characterized by slightly lower equity profitability rate and slightly smaller technical efficiency coefficient. They have slightly bigger surface of UAA, they bear lower total labour expenditures per 1 ha of UAA and are characterized by almost identical average capital value. Also they have almost identical share of farms not using calcium fertilizers in the overall number of farms. These farms achieve, however, smaller productivity of basic production factors and lower income per 1 ha of UAA. But then, in the case of income per 1 ha of UAA the difference to their disadvantage is, small enough to be statistically insignificant. These farms are characterized by extended reproduction of fixed assets, and the rate of this reproduction is higher than in other farms. Therefore, in spite of having worse operation conditions the farms from the LFA lowland areas I have a perspective for further development opportunities.
- Farms from the LFA lowland II areas, with specific handicaps, mountain areas and particularly affected by agricultural drought as compared to other farms are characterized by definitely worse equity profitability rate and low technical efficiency coefficient. They have smaller utilised agricultural area, bear larger total labour expenditures per 1 ha of UAA and are characterized by lower average capital value. Furthermore, they have definitely larger share of farms not using calcium fertilizers, what probably additionally limits their basic production factors productivity. Moreover, they obtain significantly lower income per 1 ha of UAA and are characterized by a negative rate of fixed assets reproduction.

Taking the above into consideration, it should be stated that profitable agricultural farms with the relatively high technical efficiency and positive rate of the fixed assets reproduction are able to operate on the LFA lowland areas I. On the other hand, bad situation concerns farms from the LFA lowland areas II, with specific handicaps, from mountain areas and particularly threatened by agricultural drought. In their case, investment of free financial resources in their own farm is not a profitable option. What is more, in the case of farms from the LFA with specific handicaps and mountain areas it brings a loss. Moreover, they are characterized by low technical efficiency and a negative rate of fixed assets reproduction.

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# EFFECTIVENESS OF POLISH HORTICULTURAL HOLDINGS<sup>28</sup> AGAINST A BACKGROUND OF SIMILAR HOLDINGS FROM THE SELECTED COUNTRIES

## Introduction

The undertaken research problem regarding the effectiveness of Polish horticultural holdings against a background of similar holdings from the selected countries, is a part of the research task entitled “Efficiency of farms and agricultural enterprises” under the subject “Farms and agricultural enterprises in the face of climatic change and the changes in the agricultural policy” being a part of the Multi-Annual Programme entitled “The Polish and the EU agricultures 2020+. Challenges, chances, threats, proposals”. In 2015, as part of this task, a study entitled “Organizacja i efektywność polskich gospodarstw specjalizujących się w uprawach polowych na tle gospodarstw wybranych krajów” (*Organisation and effectiveness of Polish holdings specialising in field crops against a background of holdings from selected countries*) was prepared [Ziętara, Zielinski 2015]. The result of that research was the selection of entities which are able to compete and are competitive from the group of the analysed holdings.

Poland is a major producer of fruit and vegetables in the European Union. In 2013, it was ranked fourth in terms of the share in production of fruit (6.7%), and vegetables (7.7%), after such countries as Spain (28.5/19.6%), Italy (26.8/20.2%) and France (13.2/8.1%). Moreover, it was the absolute leader in production of apples. In 2013, the share of Poland in production of apples in the EU amounted to 26.3%, while that of Italy and France was, respectively: 18.7% and 17.8%. Fruit and vegetables and their products are an important element of foreign trade in agri-food products. The share of fruit and vegetables and their products in the export of agri-food products in 2012-2015 ranged from 13.5% to 10.5%, including fruit and their products ranging from 10% to 7%. The decreasing share of fruit and their products in the export was the result of a higher growth rate of the export of agri-food products. The share of fruit and their products in the import of agri-food products was higher and amounting to 11%, due to the higher share of fresh fruit, mostly citrus fruit. The share of fruit

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<sup>28</sup> In the economic-agricultural literature, the name of horticultural holdings is given to fruit-growing and vegetable-growing holdings (Encyklopedia Ekonomiczno-rolnicza PWRiL 1984). Currently, in the statistics we use the applicable classification of holdings according to the European Union standards (Commission Regulation (EC) No. 1242/2008 of 2 December 2008 as in “Charakterystyka gospodarstw rolnych w 2013 r.”, GUS, 2014). In accordance with the adopted typology of holdings, we distinguish the P2 agricultural type of holdings specialising in horticultural crops (vegetables, strawberries, flowers and ornamental plants), fungi and in nurseries and the P3 type specialising in permanent crops (fruit trees and bushes).

and their products in the export of agri-food products, which in 2012-2015 amounted, on average, to 8.5% was more than three times higher than the share of the area of permanent crops (including orchards) in the utilised agricultural area, which in 2014 was 2.36%. This was the effect of the higher land productivity in case of permanent crops. In 2014, the value of commodity production of fruit per 1 ha of the utilised agricultural area was PLN 11.76 thousand and of vegetables – about PLN 40 thousand, while of commodity crop production – PLN 2.14 thousand/ha of UAA. Production of fruit and vegetables contributes to the fuller use of the production potential of Polish agriculture, which so far has not been fully tapped.

Given the importance of production of fruit and vegetables in Polish agriculture, conducted in the holdings, there is a need to study their effectiveness and competitive capacity. These holdings do not compete directly with holdings from other countries. What directly competes in the EU and global markets, are commercial and processing industry enterprises, however, their competitiveness is determined by the costs of raw materials (fruit and vegetables) produced in holdings [A. Woś, 2003].

### **Objective and method of research**

The objective of the research was to assess the effectiveness and competitiveness of the Polish fruit-growing and vegetable-growing holdings when compared to similar holdings in the selected European Union (EU) countries. The subject of the research were the holdings specialising in the cultivation of fruit trees and bushes (exclusive of vines and olives), covered by the FADN monitoring system<sup>29</sup>, as the type 36. The criterion adopted for selection of the countries was their share in production of fruit and vegetables (in 2013) in the EU and their situation. The share of Poland in production of fruit and vegetables in the EU is presented in Table 1.

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<sup>29</sup> FADN – Farm Accountancy Data Network

Table 1. Share of Poland in production of fruit and vegetables in the European Union in 2013.

Countries	Share of Poland in production of fruit (%)	Share of Poland in production of vegetables (%)
Spain	28.5	19.6
Italy	26.8	20.2
France	13.2	8.1
Poland	6.7	7.7
Netherlands	1.1	7.5
Romania	3.7	6.2
Germany	3.8	5.3
Hungary	2.1	2.2

Source: *Rocznik Statystyczny Rolnictwa, GUS 2015, pp. 428; 429.*

According to the first criterion, the research covered the fruit-growing and vegetable-growing holdings from: Spain, Italy and France, while according to the criterion of situation: Germany, Romania, Hungary, the Netherlands. The three-year research period covered the years between 2011 and 2013. The year 2013 was the last one when data from the European FADN were available. The research covered the holdings taking into account the division into classes according to the economic size expressed by the Standard Output (SO) value in EUR thousand per holding. The following six classes of the economic size have been identified: Very small EUR 2-< 8 thousand; Small EUR 8-< 25 thousand; Medium-small EUR 25-< 50 thousand; Medium-large EUR 50-< 100 thousand; Large EUR 100-< 500 thousand and Very large  $\geq$ EUR 500 thousand SO. Table 2 provides the number of the holdings covered by the research from individual countries. The size of the analysed holdings was diverse. In addition, the research did not cover the holdings from all economic size classes.

Table 2. Number and size of the analysed holdings in 2011-2013

Countries	Economic size of the holdings (EUR thousand of SO)					
	<8	8 - <25	25 - <50	50 - <100	100 - <500	≥500
	Number of the analysed holdings with permanent crops (fruit-growing, type 36)					
Poland	15 - <40	200-<500	100-<200	15 - <40	*	*
Hungary	*	15 - <40	15 - <40	15 - <40	15 - <40	*
Romania	15 - <40	40 - <100	*	*	15 - <40	*
Germany	*	*	*	15 - <40	100 - <200	*
Netherlands	*	*	*	*	15 - <40	*
France	*	*	15 - <40	40 - <100	200 - <500	*
Italy	15 - <40	200 - <500	200 - <500	200 - <500	100 - <200	15 - <40
Spain	40 - <100	200 - <500	100 - <200	100 - <200	100 - <200	*
	Number of the analysed holdings with vegetable crops, type 21 and 22					
Poland	*	100-<200	40-<100	40-?<100	40-<100	*
Hungary	*	15-<40	15-<40	15-<40	15-<40	*
Romania	40-<100	40-<100	15-<40	*	*	*
Germany	*	*	*	40-<100	200-<500	100-<200
Netherlands	*	*	*	15-<40	100-<200	200-<50
France	*	*	15-<40	40-<100	200-<500	40-<100
Italy	*	100-<200	100-<200	100-<200	200-<500	40-<100
Spain	*	40-<100	100-<200	200-<500	200-<500	40-<100

Source: European FADN.

The biggest representation was that of the Italian holdings, as the fruit-growing holdings were represented in all classes, and the vegetable-growing holdings were also represented only except for the smallest classes, of up to EUR 8 thousand of SO. The smallest representation was that of the Dutch holdings, as the fruit-growing holdings were represented only in the class of large holdings (EUR 100-500 thousand), and the vegetable-growing holdings – in the last three classes. The German holdings were represented at a similar level. The Polish fruit-growing holdings were represented in the first four classes, while the vegetable-growing holdings were not represented in the smallest and the largest class. The lack of data from the holdings in some classes resulted from the fact that participation of farmers in the research was voluntary, and the minimum size of a group was 15 holdings. The basis for the analysis

were the averages from the analysed three-year period. The application of the three-year averages was justified by low variability. The basis of the characteristics of the analysed holdings were the calculated indicators of: production potential, production organisation, costs and effects.

### Indicators of the assessment of the analysed holdings

#### I. Production potential of the holdings:

- 1) Economic size of the holdings expressed in SO,
- 2) Utilised agricultural area in ha,
- 3) Share of leased land (%),
- 4) Total labour input (AWU/holding),
- 5) Share of own labour (FWU/AWU x 100),
- 6) Value of assets (EUR thousand/ha),
- 7) Value of assets (EUR thousand/AWU),
- 8) Share of fixed assets in assets (%),
- 9) Share of equity in liabilities (%).

#### II. Production organisation:

- 1) Share of orchards and vegetables in UAA (%),
- 2) Share of other crops in UAA (%),
- 3) Share of crop production in total production (%),
- 4) Share of animal production in total production (%),
- 5) Share of other production in total production (%),
- 6) Share of production transferred to the household (%).

#### III. Level of costs by type:

- 1) Total costs (EUR thousand/ha),
- 2) Direct costs (EUR thousand /ha),
- 3) Costs of plant protection product (EUR thousand/ha),
- 4) Total seed costs (EUR thousand/ha),
- 5) including costs of own seeds (EUR thousand/ha),
- 6) Cost of paid labour (EUR thousand/ha),
- 7) Cost of interest (EUR thousand/ha),
- 8) Cost of ground rent (EUR thousand/ha),
- 9) Cost of depreciation (EUR thousand/ha).

#### IV. Productivity and effectiveness of the holdings:

- 1) Land productivity (production of EUR thousand/ha),
- 2) Assets productivity (production/assets – times),
- 3) Current assets productivity (production/current assets – times),
- 4) Labour productivity (EUR thousand/AWU),

- 5) Land profitability (holding income in EUR thousand/ha),
- 6) Asset profitability (holding income/assets – %),
- 7) Production viability (production/costs – %),
- 8) Own labour profitability (holding income EUR thousand/FWU),
- 9) Production profitability (holding income/production – %),
- 10) Profit of the entrepreneur (EUR thousand/holding)<sup>30</sup>,
- 11) Holding income parity (%),
- 11A) in relation to payment for paid labour in agriculture (%),
- 11B) in relation to payment in the national economy (%),
- 12) Net investment rate (%),
- 13) Competitiveness index.

Table 3 provides the costs of using own factors of production: land, labour and capital. These values are necessary to calculate the income parity ratio<sup>31</sup>: A1 and A2, profit of the entrepreneur and competitiveness index. Alternative costs of own land have been adopted at the level of ground rent in the relevant economic size classes.

Costs of own 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 relevant economic size classes, as a basis for the calculation of income parity A1, and (b) on the basis of the average level of remunerations in the national economy, as a basis for the calculation of income parity A2.

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<sup>30</sup> Profit of the entrepreneur – is a difference between holding income and costs of using own factors of production (labour, land and capital). The equivalent category is management income which has been used by the authors so far.

<sup>31</sup> Income parity: ratio of holding income per 1 FWU (FWU – Family Work Unit = 2,120 hours of own labour a year). It is calculated in relation of the average remuneration for paid labour in the given economic size class of the holding (A1) or to the average remuneration in the national economy (A2).



Table 3. Costs of using own factors of production in the analysed holdings in 2011-2013

Countries	Economic size of the holdings (thousand EUR of SO)					
	<8	8 - 25	25 - 50	50 - 100	100 - 500	>500
<b>Costs of land EUR/ha</b>						
Poland	168.2 <sup>a</sup> /- <sup>b</sup>	78.6/115.2	78/129.4	110.1/184	-/176.9	-/-
Hungary	-/-	40.7/106	95.4/330.7	85.9/273	105.6/642.1	-/-
Romania	125/2 12.1	131.8/197.6	-/137.2	-/-	87/-	-/-
Germany	-/-	-/-	-/-	305.4/719. 9	464.5/644.6	-/885.6
Netherlands	-/-	-/-	-/-	-/2170.2	1493.2/2572. 4	-/3600.4
France	-/-	-/-	313.2/2828. 2	266.6/911. 1	333.5/608.3	-/474.6
Italy	92.1/-	222.1/1703. 8	342/755.8	327.1/448. 8	300.9/604	733.7/790. 4
Spain	47.6/-	190.9/765.5	259.8/1441. 9	337.2/924. 3	294.7/346.6	-/481.3
<b>Labour costs EUR/labour hour in agriculture</b>						
Poland	2.08/-	2.01/2.09	2.01/1.91	1.96/2.1	-/2.73	-/-
Hungary	-/-	2.28/2.39	2.54/2.45	2.25/3.36	2.82/2.69	-/-
Romania	1.55/1 .32	1.55/1.46	-/1.62	-/-	1.95/-	-/-
Germany	-/-	-/-	-/-	6.65/9.59	7.65/8.86	-/8.63
Netherlands	-/-	-/-	-/-	-/15.59	11.47/14.1	-/15.66
France	-/-	-/-	12.33/13.09	10.34/11.9 6	11.83/13.2	-/14.13
Italy	7.61/-	7.47/6.58	7.51/8.67	8.11/8.78	8.7/9.02	8.43/9.52
Spain	6.95/-	6.81/5.98	7.25/5.28	7.35/5.64	7.49/6.85	-/8.1
<b>Cost of labour in the national economy (EUR/h)</b>			<b>Cost of capital according to 10-year bonds (%)</b>			
Poland	4.8			5.01		
Hungary	4.7			7.18		
Romania	2.8			6.49		
Germany	19.1			1.89		
Netherlands	20.8			2.29		
France	16.5			2.46		
Italy	13.3			4.58		
Spain	12.6			5.31		

<sup>a</sup> fruit-growing holdings, <sup>b</sup> vegetable-growing holdings

Source: own calculations based on the Central Statistical Office (CSO, Główny Urząd Statystyczny, GUS), National Bank of Poland, Hungarian Central Statistical Office, National Institute of Statistik (Romania), Stitistisches Bundesamt, www.stats.oecd.org, European Central Bank.

The competitiveness of the holdings has been determined using the competitiveness index ( $Wk$ ) according to W. Kleinhanss<sup>32</sup>. The competitiveness index (times) has been established as a quotient of holding income and a total of estimated costs of using own factors of production: own labour, land and capital (Equation 1). The value of the competitiveness index  $Wk \geq 1$  indicates that income completely covers the costs of own factors of production, while  $Wk < 1$  indicates that this coverage is incomplete. According to Kleinhanss, the further classification of  $Wk$  has been adopted, by identifying the following classes:  $Wk$  (-) – in case of negative  $Dzgr$  ( $Wk1$ ),  $0 < Wk < 1$  – partial coverage of the costs of own factors of production ( $Wk2$ ),  $1 = Wk < 2$  – complete coverage of the costs of own factors of production ( $Wk3$ ),  $Wk \geq 2$  – double and higher coverage of the costs of own factors of production ( $Wk4$ ). The competitiveness index  $Wk4$  indicates the full competitive capacity of the agricultural holding. This claim is consistent with Biswanger's opinion, who states that the enterprise able to develop should achieve the profit rate twice higher than the loan interest rate<sup>33</sup>.

$$Wk = \frac{Dzgr}{Kwz + Kw p + Kw k} \quad (1)$$

where:

$Wk$  – competitiveness index,

$Dzgr$  – agricultural holding income,

$Kwz$  – alternative cost of own land,

$Kw p$  – alternative cost of own labour,

$Kw k$  – alternative cost of own capital (without own land).

In this study, the competitiveness has been defined as the holding's ability to develop. This ability is gained by the holding when holding income twice covers the costs of own factors of production. This approach is different from the traditional definition of the competitiveness, as obtaining an advantage (in terms of cost, price, quality, etc.) in relation to competitors. The authors previously defined the competitive capacity of the holdings, using the "profit of the entrepreneur" category, parity income and net investment rate [W. Zięta, J. Sobirajewska, 2012].

<sup>32</sup> Kleinhanss W., 2015, *Konkurencyjność głównych typów gospodarstw rolniczych w Niemczech*, *Zagadnienia Ekonomiki Rolnej*, nr 1/2015.

<sup>33</sup> Biswanger H.Ch., 2011, *Spirala wzrostu, pieniądz, energia i kreatywność w dynamice procesów rynkowych*, ZYSK I S-KA, Poznań

## Selected characteristics of the Polish horticultural holdings and their importance to production and foreign trade

The figures describing horticultural production in Poland are presented in Table 4. The area of permanent crops which covers the area of orchards and fruit bushes in the analysed years of 2010-2014 was about 416 thousand ha, showing little variation, which amounted to 8%. The share of those crops in the utilised agricultural area amounted to 2.87%, on average. It was within the range from 2.76% in 2014 to 2.97% in 2012. But, the share of commodity production of fruit in agricultural commodity production was 5.82% and was twice higher than the share of those crops in UAA. The value of commodity production of fruit per ha at that time was PLN 10.20 thousand and was five times higher than the value of crop commodity production, which amounted to PLN 2.19 thousand/ha. The cultivation area of vegetables in that period amounted to 162 thousand ha and was by 61% smaller than the area of permanent crops. The variability of the cultivation area of vegetables was around 10%. The share of the cultivation area of vegetables in the area of sowings was, on average, 1.56%, while the share of vegetables in agricultural commodity production in that period amounted to 8.3% and was more than 5 times higher than the share of vegetables in the area of sowings. This was the effect of the definitely higher value of commodity production of vegetables per 1 ha, which in that period amounted to about PLN 38 thousand/ha.

Table 4. Utilised agricultural area, area of permanent crops and vegetables and commodity production in Poland in 2010-2014

Specification	Years			
	2010	2012	2013	2014
Utilised agricultural area (thousand ha) <sup>a</sup>	14,448.0	14,529.0	14,410.0	14,424.0
Permanent crops (thousand ha) <sup>b</sup>	410.0	431.8	424.7	398.2
Share of permanent crops in UAA (%)	2.83	2.97	2.94	2.76
Cultivation area of vegetables (thousand ha)	158.7	175.5	142.1	172.4
Share of vegetables in the area of sowings (%)	1.53	1.69	1.38	1.65
Crop commodity production (PLN thousand/ha of UAA)	1.81	2.29	2.49	2.17
Commodity production of fruit (PLN thousand/ha)	7.59	10.47	12.95	10.10
Commodity production of vegetables (PLN thousand/ha)	31.15	35.14	53.49	43.65
Share of fruit in agricultural commodity production (%)	5.2	6.0	6.9	5.2
Share of vegetables in agricultural commodity production (%)	7.5	7.4	9.0	9.3

a – agricultural area in good agricultural condition, b – orchards and fruit bushes

Source: *Rocznik Statystyczny Rolnictwa, GUS 2015.*

In fruit-growing and vegetable-growing production, we may observe strong processes of concentration, which are manifested by a decrease in the number of holdings, as evidenced by the figures in Table 5 for 2010 and 2013. They refer to agricultural types according to the FADN. In this relatively short period, the number of the fruit-growing holdings decreased by 22%, mainly smaller holdings, up to 1 ha, as by 86%. On the other hand, the number of the holdings exceeding 1 ha increased by 10%, including the holdings of more than 5 ha by 20%. The effect of those changes was the increase in the average area of the fruit-growing holding by 24%, from 5.01 ha to 6.23 ha. In the group of vegetable-growing holdings, the processes of concentration were stronger. Their number in the analysed period decreased by 42%, from 45.8 thousand in 2010 to 26.6 thousand in 2013. The major decrease took place in the small holdings, up to 1 ha, as by 74%. In the holdings of more than 1 ha, the decrease was 28%, and in the largest holdings with the area of more than 5 ha it was 14%. The effect of those changes was an increase in the average area of the vegetable-growing holdings by 53%, from 3.46 ha in 2010 to 5.30 ha in 2013. It may be assumed that the main reason for the reduced number of the horticultural holdings were both the economic conditions manifesting themselves in a decrease in the unit production viability and the market conditions resulting from the increasing trade requirements as regards the quality and scale of production.

Table 5. Number of the fruit-growing and vegetable-growing holdings in Poland in 2010-2013

Specification	Fruit-growing				Vegetable-growing			
	2010		2013		2010		2013	
	Number in thousand	%	Number in thousand	%	Number in thousand	%	Number in thousand	%
Total	81,739	100	63,868	100	45,845	100	26,584	100
Up to 1 ha	27,317	33.4	3,938	6.2	14,321	31.2	3,746	14.1
>1 ha	54,422	66.6	59,930	93.8	31,524	68.8	22,802	85.9
including >5 ha	20,198	24.7	24,162	37.8	11,393	24.8	9,810	36.9
Average farm area	5.01	x	6.23	x	3.46	x	5.30	x

Source: *Charakterystyka gospodarstw rolniczych. PSR 2010, GUS, 2012, Charakterystyka gospodarstw rolniczych w 2013 r. GUS, 2015.*

Fruit and vegetables also play a significant role in foreign trade in these products. The export of fruit and their products in 2011-2015 increased by 22%, from EUR 1,366.8 million in 2011 to EUR 1,671.9 million in 2015. The trade balance of these products in all years apart from 2015 was positive. The share of

fresh fruit in the export was about 34%, while in the import – about 65%. As a result, the trade balance of fresh fruit was negative. The main direction (about 70%) of the export of fruit and their products were the EU countries. Similar trends took place in foreign trade in vegetables and their products. The export value of those products in the analysed period increased by 35%, from EUR 547.2 million in 2011 to EUR 736.7 million in 2015 [Analizy rynkowe 2012-2016].

### **Agriculture and Polish horticultural holdings against a background of the analysed countries**

The production potential of Polish agriculture is significant. It is evidenced by the figures provided in Table 6. In 2013, the utilised agricultural area in Poland was 14.41 million ha. More area was in possession of only: Spain, France and Germany. Only Romania and Hungary had more area *per capita*. It was accordingly: 0.69 ha and 0.54 ha, while in Poland it was 0.37 ha and was four times larger than in the Netherlands, Germany and Italy, where it was 0.10 ha. The labour potential in Polish agriculture is very high. The number of full-time employed persons (AWU)<sup>34</sup> in Polish agriculture in 2013 amounted to 1,858 thousand, and per 100 ha of UAA it was 12.9. This number was higher only in Romania, where it amounted to 19.8 AWU/100 ha of UAA.

Table 6. Selected characteristics of agriculture of the analysed countries in 2013

Countries	UAA in thousand ha	Employed in agriculture, in thousand	Employed per 100 ha of UAA	Area of ha/ <i>per capita</i>		Share of agriculture in GDP (%)
				UAA	ArL	
Poland	14,410.0	1,858.0	12.9	0.37	0.30	2.40
Hungary	5,300.0	291.0	5.5	0.54	0.40	2.80
Romania	13,900.0	2,753.0	19.8	0.69	0.40	5.50
Germany	16,700.0	645.0	3.8	0.20	0.10	0.50
Netherlands	1,800.0	220.0	12.2	0.11	0.10	1.50
France	28,800.0	749.0	3.1	0.44	0.30	1.40
Italy	13,600.0	901.0	6.6	0.28	0.10	1.70
Spain	26,900.0	742.0	2.7	0.50	0.30	2.30

Source: *Statistisches Jahrbuch über Ernährung, Landwirtschaft und Forsten, Landwirtschaftsverlag 2015.*

High labour resources in agriculture may not be assessed positively in an unanimous manner. It is related to the level of intensity of agricultural production and labour productivity in agriculture. Examples are Poland and the Netherlands, where the level of employment in agriculture was similar and

<sup>34</sup> AWU – Annual Work Unit – unit of work in agriculture based on the annual working time of a working person, amounting to 2,120 hours.

amounted to 12.9 and 12.2 AWU/100 of UAA, respectively. In contrast, the labour productivity determined by the standard output (SO) value per 1 AWU in the individual Dutch holdings in 2010 amounted to EUR 118.7 thousand SO/AWU and was by 12 times higher than in the Polish holdings.

The differences in the labour productivity in the holdings of legal persons were definitely smaller. The labour productivity in the Dutch holdings was by 2.5 times higher than in the Polish holdings<sup>35</sup>. The share of agriculture in GDP was diversified and strictly related to the level of economic development of the country. In Poland, in 2013 it was 2.4% and was similar to that of Hungary and Spain, where it was, respectively: 2.8% and 2.3%. The highest was in Romania, where it was at 5.5% while it was the lowest in Germany, where it was at 0.5%, and then in France, the Netherlands and Italy, where it was, respectively: 1.4%; 1.5% and 1.7%.

The importance of the fruit-growing and vegetable-growing holdings in the analysed countries was diversified. As the indicators, the share of those holdings in the total number of holdings and the share in UAA of the given countries were adopted. The relevant figures are shown in Table 7.

Table 7. Share of the fruit-growing and vegetable-growing holdings and their area (UAA) in the analysed countries in 2010

Countries	Share in the number of the holdings (%)		Share in UAA (%)	
	Fruit-growing	Vegetable-growing	Fruit-growing	Vegetable-growing
Poland	3.8	2.4	2.3	1.4
Hungary	14.8	1.7	3.1	0.6
Romania	4.3	0.6	2.3	0.3
Germany	7.8	2.8	1.3	0.4
Netherlands	2.5	14.1	1.2	5.1
France	17.9	3.1	5.0	0.5
Italy	55.0	2.3	20.9	1.2
Spain	48.7	3.6	17.7	1.1
EU-27	20.1	2.0	6.6	0.7
EU-15	39.3	2.7	8.4	0.7
EU-12	5.7	1.5	2.0	0.7

Source: *Gospodarstwa rolne w Polsce na tle gospodarstw w UE – wpływ WPR. Powszechny Spis Rolny 2010. Work ed. by W. Poczta, pp. 129 and 131.*

The share of the fruit-growing holdings in the total number of the holdings was very diversified, ranging from 2.5% (Netherlands) to 55% (Italy). In Poland, it amounted to 3.8% and was similar to that of Romania (4.3%) and

<sup>35</sup> *Gospodarstwa rolne w Polsce na tle gospodarstw w Unii Europejskiej – wpływ WPR. PSR 2010. Work ed. by W. Poczta. Warsaw 2013 p. 59.*

Spain (5.7%). A similar level of diversification occurred in the share of the orchards in UAA. In Poland and Romania that share was at 2.3%. The highest was in Italy and Spain, where it was, respectively: 20.0% and 17.7%. In Germany and the Netherlands, the share of the orchards in UAA was low and amounted to, respectively: 1.3% and 1.2%.

Of different importance were the vegetable-growing holdings. Definitely, the highest share of the vegetable-growing holdings occurred in the Netherlands, where it was 14.1%. In other countries, it ranged from 0.6% (Romania) to 3.6% (Spain). In Poland, the share of the vegetable-growing holdings was 2.4%. A similar scale of diversification occurred in the cultivation area of vegetables. The highest share was in the Netherlands, where it amounted to 5.1%. The lowest share of the cultivation area of vegetables was in Romania (0.3%), Germany (0.4%) and France (0.5%). In Poland, the cultivation of vegetables occupied 1.4% of UAA and was ranked second after the Netherlands.

### **Competitive position of the Polish fruit-growing holdings**

The competitive position of the Polish fruit-growing holdings has been determined using the competitiveness index  $W_k$ , calculated as a relationship between agricultural income and the costs of own factors of production. The figures describing the competitive capacity of the fruit-growing holdings are shown in Table 10. It results from them that all holdings from the classes: <EUR 8 and 8-25 thousand of SO were deprived of the competitive capacity. In another class of EUR 25-50 thousand of SO, the Hungarian, Italian and Spanish holdings were deprived of this capacity. In the class of EUR 50-100 thousand of SO, the competitive capacity was lacking in case of the French, Italian and Spanish holdings, and in the class of EUR 100-500 thousand of SO – the Dutch and Spanish holdings. The above-mentioned groups of the uncompetitive holdings were excluded from the further analysis. From the figures provided in Table 8 it results that the competitive capacity in the economic size class of EUR 25-50 thousand of SO has been shown by the Polish and French fruit-growing holdings. In the class of EUR 50-100 thousand of SO, this capacity has been shown by the Polish, Hungarian and German holdings, while in the class of EUR 100-500 thousand of SO – by the Hungarian, German, French holdings as well as by the Italian holdings in the class of  $\leq$  EUR 500 thousand of SO. Fully competitive were the Romanian holdings in the class of EUR 100-500 thousand. The holdings able to compete ( $W_k3$ ) and competitive ( $W_k4$ ) achieved positive profit of the entrepreneur, income parity A2 above 100% and the positive net investment rate. An exception were the German holdings which in the class of

EUR 50-100 thousand of SO did not fully meet those requirements. In those holdings, Wk3 was 0.99. However, they were regarded as able to compete.

The question arises about the organisational and economic characteristics of the holdings able to compete and competitive. The appropriate figures were presented in the following tables. Owing to the fact that fully competitive proved to be only the Romanian holdings in the class of EUR 100-500 thousand of SO, they were not separately analysed. Table 9 shows the figures describing the factors of production in the analysed fruit-growing holdings able to compete and competitive.

Table 8. Competitive capacity of the Polish fruit-growing holdings against a background of selected countries

SO in EUR thousand	Poland	Hungary	Romania	Germany	Netherlands	France	Italy	Spain
Competitive index Wk (times)								
< 8	0.43	-	0.52	-	-	-	0.18	0.34
8 – 25	0.72	0.52	0.83	-	-	-	0.46	0.61
25 – 50	1.02	0.90	-	-	-	1.14	0.59	0.63
50 – 100	1.00	1.74	-	0.99	-	0.87	0.75	0.84
100 – 500	-	1.51	2.34	1.44	0.73	1.45	0.86	1.09
>500	-	-	-	-	-	-	1.13	-
Profit of the entrepreneur (EUR thousand/holding)								
<8	-5.85	-	-3.47	-	-	-	-13.66	-11.76
8 – 25	-4.25	-3.59	-1.70	-	-	-	-11.92	-8.65
25 – 50	0.47	-0.43	-	-	-	3.99	-14.36	-10.18
50 – 100	0.41	19.33	-	-0.10	-	-3.46	-12.04	-6.05
100 – 500	-	26.21	53.11	19.60	-19.49	16.75	-11.28	5.03
>500	-	-	-	-	-	-	26.5	-
Net investment rate (%)								
< 8	-66.4	-	-56.6	-	-	-	-83.5	-85.6
8 – 25	-24.5	-74.5	-85.5	-	-	-	46.5	-56.1
25 – 50	15.5	-24.5	-	-	-	-16.6	24.5	22.0
50 – 100	58.8	20.5	-	-20.3	-	-15.6	11.0	15.1
100 – 500	-	-22.7	81.7	13.7	27.4	-4.5	17.7	17.7
>500	-	-	-	-	-	-	-160.5	-
Income parity A2 (%)								
< 8	35.6	-	53.5	-	-	-	14.8	36.4
8 – 25	67.7	64.7	98.1	-	-	-	40.9	69.7
25 – 50	129.7	193.5	-	-	-	99.7	66.1	70.4
50 – 100	185.0	451.9	-	54.1	-	63.8	99.4	112.0
100 – 500	-	1419.1	3089.1	97.6	81.5	126.7	168.5	186.5
>500	-	-	-	-	-	-	500.8	-

Source: European FADN.

The area of the fruit-growing holdings which are able to compete is strongly diversified among the analysed countries and shows a relation to the economic size. In addition, the area of the fruit-growing holdings in the Western European countries is smaller than that of the holdings from the Eastern European countries. In the size class of EUR 25-50 thousand of SO, the area of the Polish holdings amounted to 17.70 ha, while that of the French holdings –



only 8.10 ha of UAA. In the class of EUR 50-100 thousand of SO the area of the Polish and Hungarian holdings was similar and amounted, respectively, to: 38.80 and 40.70 ha of UAA, while that of the German holdings was only at 9.10 ha of UAA. In the class of EUR 100-500 thousand of SO, the Hungarian and Romanian holdings used about 100 ha of UAA each, while the German, French and Spanish holdings, respectively: 22.40; 38.80 and 32.40 ha of UAA. The largest class of EUR 500 and more thousand of SO included only the Italian holdings, which used 93.50 ha of UAA.

The share of leased land was also diversified and showed an upward trend as the economic size of the holdings increased. In the economic size classes of EUR 25-100 thousand of SO, the share of leased land ranged from 10.40 (Poland) to 54.60% (France). In the Hungarian and German holdings, it was respectively: 14.50 and 25.10%. In the class of EUR 100-500 thousand of SO it was by far higher, ranging from 43.50 (Germany) to 88.20% (France). An exception were Italy and France, where the share of leased land was about 24%.

Total labour inputs expressed in AWU/holding increased along with the increase in the economic size of the holdings and were lower in the holdings from the Western European countries. In the Polish and Hungarian holdings with the economic size classes of EUR 25-100 thousand of SO, they ranged from 3 (Hungary) to 4.4 (Poland) AWU, while in the French and German holdings: 1.89 and 1.9 AWU, respectively, and were lower by 50%. In the class of EUR 100-500 thousand of SO, the labour inputs in the Hungarian and Romanian holdings were about 10 AWU/holding, while in the German, French and Spanish holdings they were about 4.5 AWU and were by 55% lower than in the first group. Diversified was also the share of own labour which decreased with increasing the economic size of the holdings. In addition, in the German and French holdings in the classes of EUR 25-100 thousand of SO it was about 65% and was by 22 pp higher than in the Polish and Hungarian holdings. In the class of EUR 100-500 thousand, the share of own labour in the total labour inputs was definitely lower. In the Hungarian and Romanian holdings, it was, respectively: 5.10% and 4.3%, while in the German, French and Spanish holdings it ranged from 27.4% to 35.80%. In the Italian holdings, in the largest class the share of own labour was 11.40%.

The value of assets per 1 ha of UAA was negatively correlated with the economic size of the holdings. In the class of EUR 25-50 thousand of SO in the Polish and French holdings it was similar and amounted to about EUR 18 thousand/ha of UAA. In other classes it was lower and ranged from EUR 4.6 thousand/ha (Romania) to EUR 16.10 thousand/ha (Spain). An exception were the German holdings, in which the value of assets in the classes of EUR 25-50

thousand and EUR 50-100 thousand of SO was, respectively: EUR 49.50 and 35.80 thousand/ha of UAA. In the highest class in the Italian holdings, the value of assets was exceptionally high and amounted to EUR 51.10 thousand/ha of UAA.

Assets were dominated by the share of fixed assets, ranging from 90% (Poland, Germany) to 51.50% (France). It showed a downward trend with the increasing economic size of the holdings. Liabilities were dominated by own capital, whose share amounted to more than 80%, with the exception of the French holdings in the class of 100-500 thousand of SO where it was 50.10%.

Table 9. Factors of production in the Polish fruit-growing holdings able to compete and competitive against a background of selected countries

SO in EUR thousand	Poland	Hungary	Romania	Germany	France	Italy	Spain
Utilised agricultural area (ha of UAA)							
25 – 50	17.70	-	-	-	8.1-	-	-
50 – 100	38.80	40.70	-	9.10	-	-	-
100 – 500	-	94.70	115.10	22.40	38.80	-	32.40
>500	-	-	-	-	-	93.50	-
Share of leased land (%)							
25 – 50	10.40	-	-	-	54.60	-	-
50 – 100	10.40	14.50	-	25.10	-	-	-
100 – 500	-	62.40	57.80	43.50	88.20	-	25.80
>500	-	-	-	-	-	23.40	-
Total labour inputs (AWU/holdings)							
25 – 50	3.60	-	-	-	1.80	-	-
50 – 100	4.40	3.00	-	1.90	-	-	-
100 – 500	-	10.10	9.70	4.30	5.90	-	3.20
>500	-	-	-	-	-	13.60	-
Share of own labour (%)							
25 – 50	50.20	-	-	-	68.50	-	-
50 – 100	36.30	36.7-	-	61.00	-	-	-
100 – 500	-	5.10	4.30	35.80	27.40	-	32.60
>500	-	-	-	-	-	11.40	-
Value of assets (EUR thousand/ha of UAA)							
25 – 50	19.20	-	-	-	17.10	-	-
50 – 100	11.80	7.30	-	49.50	-	-	-
100 – 500	-	8.10	4.60	36.20	10.50	-	16.10
>500	-	-	-	-	-	51.10	-
Share of fixed assets in assets (%)							
25 – 50	87.60	-	-	-	71.10	-	-
50 – 100	89.90	78.60	-	89.90	-	-	-
100 – 500	-	74.20	67.60	88.70	51.50	-	69.70
>500	-	-	-	-	-	75.70	-
Share of own resources in liabilities (%)							
25 – 50	94.10	-	-	-	81.40	-	-
50 – 100	93.30	86.40	-	86.90	-	-	-
100 – 500	-	82.20	98.10	81.80	50.10	-	96.90
>500	-	-	-	-	-	100.00	-

Source: European FADN.

A distinctive feature of the fruit-growing holdings able to develop is the significant share of the area of orchards in UAA (Table 10). In all analysed holdings, it exceeded 50%. It mostly ranged from 60% to 80%. It was the highest in the Polish holdings in the class of EUR 25-50 thousand of SO and in the Italian holdings in the class of EUR 500 and more thousand of SO where it was, respectively: 81.8% and 82.7% while it was the lowest in the French holdings in the class of EUR 100-500 thousand of SO, where it amounted to 51.7%. The high share of orchards in UAA was reflected in the structure of production, dominated by crop production. Its share in all holdings exceeded 90%, with the exception of the German holdings, where it was lower and amounted, respectively, to: 84% and 88% in the classes of EUR 50-500 thousand of SO.

There were strong differences in the production intensity level determined by the total costs per 1 ha of UAA (Table 10). In the Polish, Hungarian and Romanian holdings those costs were similar, ranging from EUR 1.50 (Romanian) to 2.85 (Hungarian) thousand/ha, they were lower than in case of other holdings. In the Italian and Spanish holdings, they were higher, within the range of EUR 3-4 thousand/ha of UAA. Definitely, the highest production intensity level was characteristic of the German and French fruit-growing holdings, where the total costs per 1 ha of UAA were within the range of EUR 6.8-8.9 thousand/ha and were by about 3 times higher than in the Polish, Hungarian and Romanian holdings.

The differences in direct costs were smaller. In the Polish, Hungarian, Romanian and Spanish holdings, they ranged from EUR 0.47 to 0.68 thousand/ha. The highest costs were in the German holdings, in which they amounted to EUR 1.41 and 1.66 thousand/ha, respectively, in the classes of EUR 50-100 and 100-500 thousand of SO. They were more than twice higher than in the Polish holdings. It should be stressed that in the Polish, Hungarian and Romanian holdings, the share of direct costs in the total costs was about 32% and was higher than in the holdings from the Western European countries, in which it amounted to about 20%. This shows that in the first group holdings, the burden of direct costs was lower, which should be rated positively.

Costs of plant protection products were also diversified. In the majority of holdings, they were about EUR 0.40 thousand/ha. An exception were the Polish holdings in the class of EUR 50-100 thousand of SO where they amounted to EUR 1.70 thousand/ha and the German holdings in the class of EUR 100-500 thousand of SO where they amounted to EUR 0.80 thousand/ha.

Costs of paid labour in the Polish, Hungarian and Romanian holdings were similar and ranged from EUR 0.24 to 0.63 thousand/ha and were clearly

lower than in the holdings from other countries in which they ranged from EUR 1.08 to 2.15 thousand/ha. The highest costs were in the German and French holdings in the class of EUR 100-500 thousand/ha, in which they exceeded EUR 2 thousand/ha.

There were also significant differences in costs of depreciation. The highest were in the German and French holdings, in which they ranged from EUR 1 to 1.68 thousand/ha. In other countries, they ranged from EUR 0.18 to 0.79 thousand/ha.

Table 10. Organisation and production intensity level in the Polish fruit-growing holdings able to develop and competitive against a background of selected countries

SO in EUR thousand	Poland	Hungary	Romania	Germany	France	Italy	Spain
Share of orchards in UAA (%)							
25 – 50	81.80	-	-	-	71.00	-	-
50 – 100	73.90	69.40	-	63.90	-	-	-
100 – 500	-	72.50	77.70	76.60	51.70	-	75.70
≥500	-	-	-	-	-	82.70	-
Share of crop production in total production (%)							
25 – 50	98.50	-	-	-	97.40	-	-
50 – 100	98.70	97.00	-	84.10	-	-	-
100 – 500	-	90.80	99.50	88.40	93.20	-	98.50
≥500	-	-	-	-	-	99.50	-
Total costs (EUR thousand/ha of UAA)							
25 – 50	2.44	-	-	-	7.61	-	-
50 – 100	1.48	1.50	-	6.89	-	-	-
100 – 500	-	2.85	1.50	8.96	6.84	-	3.09
≥500	-	-	-	-	-	3.87	-
Direct costs (EUR thousand/ha of UAA)							
25 – 50	0.61	-	-	-	1.05	-	-
50 – 100	0.68	0.46	-	1.41	-	-	-
100 – 500	-	0.54	0.47	1.66	1.12	-	0.66
≥500	-	-	-	-	-	0.96	-
Costs of plant protection products (EUR thousand/ha of UAA)							
25 – 50	0.32	-	-	-	0.29	-	-
50 – 100	1.70	0.43	-	0.50	-	-	-
100 – 500	-	0.39	0.31	0.80	0.45	-	-
≥500	-	-	-	-	-	0.45	0.34
Costs of paid labour (EUR thousand/ha of UAA)							
25 – 50	0.43	-	-	-	1.45	-	-
50 – 100	0.31	0.24	-	1.22	-	-	-
100 – 500	-	0.63	0.40	2.12	2.15	-	1.08
≥500	-	-	-	-	-	1.97	-
Costs of depreciation (EUR thousand/ha of UAA)							
25 – 50	0.79	-	-	-	1.54	-	-
50 – 100	0.44	0.48	-	1.29	-	-	-
100 – 500	-	0.40	0.18	1.68	0.92	-	0.24
≥500	-	-	-	-	-	0.48	-

Source: European FADN.

The figures describing the productivity of factors of production in the analysed holdings are provided in Table 11. The land productivity determined by the production value per 1 ha of UAA in the Polish, Hungarian and Romanian holdings was similar, ranging from EUR 1.88 (Hungary) to 3.65 thousand/ha and was lower than in the fruit-growing holdings from other countries. Among them, it was the lowest in the Spanish holdings, where it amounted to EUR 4.26 thousand/ha. It was definitely higher in the German and French holdings, in which it ranged from EUR 7.43 (French) to 11.40 (German) thousand/ha. Definitely, it was the highest in the Italian holdings, where it amounted to EUR 25.21 thousand/ha in the class of EUR 500 thousand and more.

The assets productivity was less diversified. In all holdings, apart from the French ones, it ranged from 0.19 (Polish) to 0.45 (Romanian). It was definitely higher in the French holdings, where it amounted to 0.64 and 0.71 in the classes of EUR 25-50 and 100-500 thousand of SO. The diversification of the current assets productivity was not high, it ranged from 0.86 (Italian) to 1.71 (Polish). An exception were the German holdings in the class of EUR 100-500 thousand of SO, in which it amounted to 2.78.

Table 11. Productivity of factors of production in the Polish fruit-growing holdings able to develop and competitive against a background of selected countries

SO in EUR thousand	Poland	Hungary	Romania	Germany	France	Italy	Spain
Land productivity (EUR thousand/ha of UAA)							
25 – 50	3.65	-	-	-	11.05	-	-
50 – 100	2.04	2.28	-	9.40	-	-	-
100 – 500	-	1.88	2.41	11.40	7.43	-	4.26
≥500	-	-	-	-	-	25.21	-
Assets productivity (times)							
25 – 50	0.19	-	-	-	0.64	-	-
50 – 100	0.17	0.27	-	0.19	-	-	-
100 – 500	-	0.36	0.45	0.31	0.71	-	0.26
≥500	-	-	-	-	-	0.21	-
Current assets productivity (times)							
25 – 50	1.54	-	-	-	1.62	-	-
50 – 100	1.71	1.23	-	1.63	-	-	=
100 – 500	-	1.40	1.59	2.78	1.46	-	0.87
≥500	-	-	-	-	-	0.86	-
Labour productivity (EUR thousand/AWU)							
25 – 50	18.00	-	-	-	49.49	-	-
50 – 100	17.82	25.88	-	44.51	-	-	-
100 – 500	-	27.00	26.20	58.66	49.09	-	37.23
≥500	-	-	-	-	-	43.46	-
Production profitability (%)							
25 – 50	40.30	-	-	-	36.10	-	-
50 – 100	41.80	60.40	-	30.7-	-	-	-
100 – 500	-	29.90	40.10	24.90	18.70	-	40.00
≥500	-	-	-	-	-	39.50	-

Source: European FADN.

The labour productivity determined by the production value per 1 AWU in the Polish, Hungarian and Romanian holdings was similar, ranging from EUR 18 to 27 thousand/AWU. It was more than twice lower than in the holdings from the Western European countries, in which it ranged from EUR 37 to 58 thousand/AWU. It was the lowest in the Polish holdings, in which it amounted to about EUR 18 thousand/AWU. It was the highest in the German holdings, in which it amounted to EUR 58 thousand/AWU.

The production profitability determined by a ratio of agricultural income to the production value in the majority of the holdings was about 40%. It was the lowest in the German and French holdings in the class of EUR 100-500 thousand, in which it was, respectively, at 19% and 25%, while the highest in the Hungarian holdings in the class of EUR 50-100 thousand, in which it was at 60%.

### **Competitive position of the Polish vegetable-growing holdings**

The competitive capacity of the analysed vegetable-growing holdings was determined, just like in case of the fruit-growing holdings, by means of the competitiveness index. The appropriate figures were presented in Table 12. From the figures provided it results that the Polish holdings able to compete were the holdings from the economic size classes of EUR 50-100 and 100-500 thousand of SO. The Hungarian holdings able to compete were the holdings from the classes of EUR 8 to 500 thousand of SO. Among the Romanian holdings, this capacity was shown only by the holdings from the class of EUR 25-50 thousand of SO. In case of the German holdings, able to compete and competitive were the holdings from two largest economic size classes which achieved the Wk value, respectively, of: 1.18 and 2.21. Among the Dutch holdings, none showed the competitive capacity. Among the French holdings, this capacity was shown only by those from the class of EUR 100-500 thousand of SO. In case of the Italian and Spanish holdings, the competitive capacity was showed by the holdings from the largest class of EUR 500 thousand of SO and more.

From the presented Wk values it results that a basic factor determining the competitive capacity of the holdings was their economic size. The holdings which did not show the competitive capacity, had lower utilised agricultural area. The Polish, German, French and Italian holdings with less than 6 ha of UAA were uncompetitive. Uncompetitive were also all Dutch holdings, also with 15 ha of UAA, French holdings with the area of 35.3 ha of UAA and Italian and Spanish holdings with the area of 7.5 and 29.6 ha of UAA, respectively. Those holdings were also characterised by the lower land and labour productivity. A question arises, whether the uncompetitive holdings may function in the market? A positive answer depends on whether the owners of the

holdings below accept labour income below parity income and lower land and capital income. This means that in their activity they are guided not only by economic objectives. However, their ability to develop over an extended period of time is limited.

Table 12. Competitive capacity of the Polish vegetable-growing holdings against a background of the selected countries

SO in EUR thousand	Poland	Hungary	Romania	Germany	Netherlands	France	Italy	Spain
Competitive index Wk (times)								
< 8	-	-	0.22	-	-	-	-	-
8 – 25	0.56	1.80	0.67	-	-	-	0.47	0.61
25 – 50	0.88	2.10	1.40	-	-	0.44	0.63	0.66
50 – 100	1.09	2.16	-	0.66	0.73	0.89	0.78	0.74
100 – 500	1.82	2.59	-	1.18	0.95	1.15	0.75	0.75
>500	-	-	-	2.21	0.81	0.88	1.15	1.15
Profit of the entrepreneur (EUR thousand/holding)								
<8	-	-	-4.40	-	-	-	-	-
8 – 25	-4.90	7.60	-2.30	-	-	-	-12.40	-10.00
25 – 50	-1.70	14.50	4.30	-	-	-17.60	-13.40	-9.10
50 – 100	1.80	30.10	-	-9.10	-16.40	-3.20	-9.90	-9.10
100 – 500	24.70	67.60	-	6.50	-3.60	6.00	-16.40	-12.30
>500	-	-	-	53.40	-23.50	-7.30	210.60	16.50
Net investment rate (%)								
< 8	-	-	-63.28	-	-	-	-	-
8 – 25	-60.24	-62.88	51.38	-	-	-	-96.32	24.89
25 – 50	-36.00	39.35	-129.20	-	-	-34.42	-95.27	25.29
50 – 100	-4.03	-28.79	-	-50.71	18.78	29.62	-94.95	-6.96
100 – 500	64.89	203.09	-	-23.95	12.18	-30.66	-36.87	-34.25
>500	-	-	-	14.37	-19.20	-38.15	-99.18	92.61
Income parity A2 (%)								
< 8	-	-	14.30	-	-	-	-	-
8 – 25	36.20	197.40	51.40	-	-	-	33.90	52.60
25 – 50	64.00	264.10	156.90	-	-	40.40	58.20	56.00
50 – 100	121.70	110.40	-	37.40	3.30	73.00	79.80	75.30
100 – 500	223.10	1,494.80	-	65.70	96.60	103.30	174.40	102.80
>500	-	-	--	150.40	108.80	87.30	616.90	350.40

Source: European FADN.

Table 13 provides the figures describing the vegetable-growing holdings able to compete and competitive. In the class of EUR 8-25 thousand of SO, the Hungarian holdings able to compete used 4.3 ha of UAA. In the class of EUR 25-50 thousand, the Hungarian and Romanian holdings used, respectively: 4.7 and 4.6 ha of UAA. In the class of EUR 50-100 thousand, the Polish and Hungarian holdings used, respectively: 8.6 and 15.3 ha of UAA. In the class of EUR 100-500 thousand, the Polish and Hungarian holdings used, respectively: 10.2 and 27.5 ha, and the German and French holdings used, respectively: 6.10 and 9.40 ha of UAA. In the highest class, EUR 500 thousand of SO and more, the German, Italian and Spanish holdings used, respectively: 21.90; 29.60 and 35.30 ha of

UAA. All analysed holdings also used leased land. Their share increased as the economic size of the holdings increased. It was the lowest in the Romanian, Hungarian and Polish holdings, ranging from 17.30% to 43.10%. On the other hand, in the remaining holdings it was higher, ranging from 51.2% to 79.30%.

Table 13. Factors of production in the Polish vegetable-growing holdings able to compete and competitive against a background of the selected countries

SO in EUR thousand	Poland	Hungary	Romania	Germany	France	Italy	Spain
Utilised agricultural area (ha of UAA)							
8 - 25	-	4.30	-	-	-	-	-
25 - 50	-	4.70	4.60	-	-	-	-
50 - 100	8.60	15.30	-	-	-	-	-
100 - 500	10.20	27.50	-	6.10	9.40	-	-
≥500	-	-	-	21.90	-	29.60	35.30
Share of leased land (%)							
8 - 25	-	29.60	-	-	-	-	-
25 - 50	-	27.70	32.60	-	-	-	-
50 - 100	17.30	34.90	-	-	-	-	-
100 - 500	16.20	43.10	-	54.10	79.30	-	-
≥500	-	-	-	68.40	-	62.50	51.20
Total labour inputs (AWU/holdings)							
8 - 25	-	2.30	-	-	-	-	-
25 - 50	-	3.30	2.40	-	-	-	-
50 - 100	3.7-	5.50	-	-	-	-	-
100 - 500	7.10	7.40	-	4.30	5.2	-	-
≥500	-	-	-	12.30	-	14.00	13.50
Share of own labour (%)							
8 - 25	-	36.80	-	-	-	-	-
25 - 50	-	30.10	61.40	-	-	-	-
50 - 100	48.60	19.70	-	-	-	-	-
100 - 500	28.30	10.0	-	34.20	32.30	-	-
≥500	-	-	-	10.0	-	15.00	11.00
Value of assets (EUR thousand/ha of UAA)							
8 - 25	-	19.64	-	-	-	-	-
25 - 50	-	27.15	15.47	-	-	-	-
50 - 100	23.95	21.84	-	-	-	-	-
100 - 500	40.71	25.63	-	50.92	32.99	-	-
≥500	-	-	-	42.19	-	62.20	24.87
Share of fixed assets in assets (%)							
8 - 25	-	61.20	-	-	-	-	-
25 - 50	-	57.90	71.30	-	-	-	-
50 - 100	89.40	57.30	-	-	-	-	-
100 - 500	92.29	65.70	-	76.40	60.40	-	-
≥500	-	-	-	74.30	-	52.00	47.90
Share of own resources in liabilities (%)							
8 - 25	-	80.80	-	-	-	-	-
25 - 50	-	75.60	98.90	-	-	-	-
50 - 100	88.70	66.70	-	-	-	-	-
100 - 500	75.40	56.80	-	64.20	40.10	-	-
≥500	-	-	-	48.00	-	95.80	98.40

Source: European FADN.



Labour inputs in the Polish, Hungarian and Romanian holdings were similar in the respective classes and higher than in the remaining holdings. In the class of EUR 100-500 thousand, in the Polish and Hungarian holdings those inputs were, respectively: 7.10 and 7.40 AWU/holding, while in the German and French holdings in the same class they were, respectively: 4.30 and 5.20 AWU/holding. The share of own labour decreased as the economic size of the holdings increased. In the Polish and Romanian holdings in the class of EUR 100-500 thousand, it was, respectively: 28.30% and 10.00% and was lower than in the German and French holdings, where in the same class it was: 34.20% and 32.30%.

The value of assets in the Polish (except for the class of EUR 100-500 thousand of SO), Hungarian, Romanian, and Spanish holdings ranged from EUR 15.47 (Romania) to 26.63 (Hungary) thousand/ha and was lower than in the other holdings in which it ranged from EUR 33 (France) to 62.20 (Italy) thousand/ha.

The share of fixed assets in assets in the Polish, Hungarian and Romanian holdings ranged from 57.30 to 89.40% and was lower than in the remaining holdings. The share of own funds in liabilities was diversified. It decreased as the economic size of the holdings increased. It was the highest in the Romanian, Italian and Spanish holdings, in which it exceeded 95%. In contrast, it was the lowest in the French and German holdings where it was, respectively: 40% and 48%.

The organisation and production intensity level in the analysed holdings were diversified. The relevant figures are provided in Table 14. The characteristic feature of the production organisation was the share of vegetables in UAA. It was the lowest in the Polish holdings, in which it amounted to 21.6% and 27.5%. In the Hungarian and Romanian holdings, it was about 50%. It was the highest in the Spanish holdings, in which it amounted to 66%. All analysed holdings were highly specialised in crop production. The share of crop production in total production was more than 98%. An exception were the German holdings in the class of EUR 100-500 thousand, in which it was 85%.

The production intensity level determined by total costs per 1 ha of UAA was diversified. In the Polish, Hungarian, and Spanish holdings it ranged from EUR 7.5 thousand/ha to EUR 17.6 thousand/ha. It was the lowest in the Romanian holdings, in which it amounted to EUR 4.12 thousand/ha, while the highest – in the German and French holdings, in which it ranged from EUR 33.5 thousand/ha to EUR 38.5 thousand/ha. Similar relationships occurred in the level of direct costs. Costs of plant protection products in the Polish and Romanian holdings ranged from EUR 0.16 to 0.29 thousand/ha and were clearly lower than in the remaining countries in which they ranged from EUR 0.33 to 0.79 thousand/ha. They were the highest in the Italian holdings. Costs of paid labour were the lowest in the Romanian and Polish holdings, in which they

amounted to, respectively: EUR 0.28 and 1.0 thousand/ha, while the highest – in the German and French holdings, in which they ranged from EUR 8.25 to 9.59 thousand/ha. Similar relationships occurred in costs of depreciation. In the Polish, Hungarian, Romanian, Italian and Spanish holdings, they ranged from EUR 0.77 (Romanian) to 2.08 (Polish). They were higher in the German and French holdings in which they ranged from EUR 3.02 to 3.55 thousand/ha.

Table 14. Organisation and production intensity level in the Polish vegetable-growing holdings able to develop and competitive against a background of selected countries

SO in EUR thousand	Poland	Hungary	Romania	Germany	France	Italy	Spain
Share of vegetables in UAA (%)							
8 - 25	-	47.10	-	-	-	-	-
25 - 50	-	59.00	46.00	-	-	-	-
50 - 100	21.6-	47.20	-	-	-	-	-
100 - 500	27.50	49.90	-	49.50	39.70	-	-
≥500	-	-	-	57.50	-	43.00	66.30
Share of crop production in total production (%)							
8 - 25	-	99.80	-	-	-	-	-
25 - 50	-	98.70	98.60	-	-	-	-
50 - 100	98.7-	98.90	-	-	-	-	-
100 - 500	99.80	98.40	-	85.60	97.40	-	-
≥500	-	-	-	92.10	-	99.60	99.80
Total costs (EUR thousand/ha of UAA)							
8 - 25	-	7.10	-	-	-	-	-
25 - 50	-	13.40	4.12	-	-	-	-
50 - 100	7.56	10.82	-	-	-	-	-
100 - 500	17.65	7.79	-	38.51	33.49	-	-
≥500	-	-	-	34.75	-	21.61	8.08
Direct costs (EUR thousand/ha of UAA)							
8 - 25	-	2.79	-	-	-	-	-
25 - 50	-	3.45	1.17	-	-	-	-
50 - 100	2.70	4.52	-	-	-	-	-
100 - 500	7.27	2.58	-	10.15	8.52	-	-
≥500	-	-	-	10.06	-	10.64	2.64
Costs of plant protection products (EUR thousand/ha of UAA)							
8 - 25	-	0.42	-	-	-	-	-
25 - 50	-	0.53	0.16	-	-	-	-
50 - 100	0.24	0.33	-	-	-	-	-
100 - 500	0.29	0.55	-	0.46	0.58	-	-
≥500	-	-	-	0.56	-	0.79	0.58
Costs of paid labour (EUR thousand/ha of UAA)							
8 - 25	-	1.79	-	-	-	-	-
25 - 50	-	2.84	0.28	-	-	-	-
50 - 100	1.00	2.20	-	-	-	-	-
100 - 500	2.89	1.48	-	9.32	8.25	-	-
≥500	-	-	-	9.59	-	5.37	3.31
Costs of depreciation (EUR thousand/ha of UAA)							
8 - 25	-	1.04	-	-	-	-	-
25 - 50	-	1.38	0.77	-	-	-	-
50 - 100	1.13	1.15	-	-	-	-	-
100 - 500	2.08	1.10	-	3.02	3.55	-	-
≥500	-	-	-	3.11	-	2.06	1.38

Source: European FADN.

The production intensity level determines the productivity of factors of production. The relevant figures are provided in Table 15. The land productivity in the Polish, Hungarian, Romanian, and Spanish holdings ranged from EUR 6.94 (Romanian) to 22.08 (Polish) thousand/ha. In the German, French and Italian holdings, it was more than twice higher, ranging between EUR 30.65 (Italian) to 44.23 (German) thousand/ha. The level of diversification of the assets productivity was definitely lower. In the Polish, Hungarian, Romanian, Italian, and Spanish holdings it was similar, ranging from 0.39 (Spanish) to 0.68 (Hungarian). On the other hand, in the German and French holdings it ranged from 0.87 to 1.13. It was higher than the previous group of the holdings by about 87%.

Table 15. Productivity of factors of production in the Polish vegetable-growing holdings able to develop and competitive against a background of selected countries

SO in EUR thousand	Poland	Hungary	Romania	Germany	France	Italy	Spain
Land productivity (EUR thousand/ha of UAA)							
8 - 25	-	11.00	-	-	-	-	-
25 - 50	-	17.79	6.94	-	-	-	-
50 - 100	9.57	14.20	-	-	-	-	-
100 - 500	22.40	10.42	-	44.23	37.34	-	-
≥500	-	-	-	37.87	-	30.65	9.72
Assets productivity (times)							
8 - 25	-	0.55	-	-	-	-	-
25 - 50	-	0.68	0.48	-	-	-	-
50 - 100	0.40	0.66	-	-	-	-	-
100 - 500	0.55	0.42	-	0.87	1.13	-	-
≥500	-	-	-	0.92	-	0.51	0.39
Current assets productivity (times)							
8 - 25	-	1.42	-	-	-	-	-
25 - 50	-	1.61	1.76	-	-	-	-
50 - 100	3.80	1.61	-	-	-	-	-
100 - 500	7.08	1.25	-	3.70	2.86	-	-
≥500	-	-	-	3.57	-	1.05	0.76
Labour productivity (EUR thousand/AWU)							
8 - 25	-	20.34	-	-	-	-	-
25 - 50	-	24.96	13.56	-	-	-	-
50 - 100	22.11	39.43	-	-	-	-	-
100 - 500	32.36	38.51	-	61.85	67.36	-	-
≥500	-	-	-	67.40	-	87.49	39.83
Production profitability (%)							
8 - 25	-	36.37	-	-	-	-	-
25 - 50	-	33.19	45.82	-	-	-	-
50 - 100	25.48	25.75	-	-	-	-	-
100 - 500	23.81	38.40	-	15.26	13.03	-	-
≥500	-	-	-	11.76	-	30.26	23.07

Source: European FADN.

The current assets productivity was the highest in the Polish holdings, in which it amounted to 3.80 and 7.08. In the German and French holdings, it ranged from 2.86 (French) to 3.70 (German). In the remaining holdings, it ranged from

0.76 (Spanish) to 1.76 (Romanian). The labour productivity was highly diversified, it was the lowest in the Romanian holdings, in which it amounted to EUR 13.56 thousand/AWU, while it was the highest in the Italian holdings, in which it amounted to EUR 87.49 thousand/AWU. In the German and French holdings, it ranged from EUR 61.85 to 67.40 thousand/AWU. In the Polish, Hungarian and Spanish holdings, it ranged from EUR 20.34 to 39.83 thousand/AWU. The production profitability determined by a ratio of agricultural income to the production value was the highest in the Romanian holdings, in which it amounted to 45.87%, while it was the lowest in the German and French holdings, in which it ranged from 11.76 to 15.26%. In the remaining holdings, it ranged from 23.07 (Spanish) to 38.40 (Hungarian).

### **Summary and conclusions**

- 1) Poland is a major producer of fruit and vegetables in the European Union. In 2013, it was ranked fourth, with the share of fruit amounting to 6.7% and of vegetables – to 7.7%, after such countries as Spain, Italy and France. It was the absolute leader in production of apples, though, with the share of 26.3%.
- 2) Land productivity of fruit-growing and vegetable-growing crops in Poland, measured by the production value per 1 ha of UAA, was several times higher than total crop production. This enabled to better use the production potential of Polish agriculture.
- 3) In fruit-growing and vegetable-growing production, strong processes of concentration occurred in Poland. In 2010-2013, the number of fruit-growing holdings decreased by 22%, and of vegetable-growing by 42%. The result of these processes was an increase in the average area of the fruit-growing holdings from 5.01 ha to 6.23 ha (24%), and of vegetable-growing holdings from 3.46 ha to 5.30 ha (53%)
- 4) Fruit and vegetables and their products play a significant role in foreign trade. Their share in the export of agri-food products in 2012-2015 amounted, respectively, to 8.5% and 4%.
- 5) Production potential of Polish agriculture is significant. This is evidenced by agricultural resources and labour resources. In terms of land resources, Poland occupies the fourth position in the EU, after France, Spain and Germany, and in terms of labour resources it is ranked second, after Romania.
- 6) Scale of production of vegetables in the Polish holdings was lower than that of the holdings in the analysed countries. This is evidenced by the lower share of the cultivation area of vegetables in UAA, which was about 25%, while in the remaining holdings it was about 50%.

7) Competitive capacity has been shown by the Polish fruit-growing holdings with the following economic size: EUR 25-50 and 50-100 thousand of SO which used, respectively: 17.70 and 38.89 ha of UAA. In addition to the Polish holdings, the competitive capacity has been shown by the French holdings from the class of EUR 25-50 thousand of SO, Hungarian and German holdings from the class of EUR 50-100 thousand of SO, Hungarian, Romanian, German, French and Spanish holdings from the class of EUR 100-500 thousand of SO and Italian holdings in the class of EUR 500 thousand of SO and more.

8) There was a fundamental difference in the production potential of the fruit-growing holdings from the Eastern European countries (Poland, Hungary, Romania), and the holdings from the Western European countries (Germany, the Netherlands, France, Italy and Spain).

9) Holdings from the first group had larger UAA. In the class of EUR 25-50 thousand of SO, UAA in the Polish holdings was 17.7 ha and was more than twice larger than that of the French holdings, in the class of EUR 50-100 thousand of SO, UAA in the Polish and Hungarian holdings was about 40 ha and was more than four times larger than that of the German holdings, in the class of EUR 100-500 thousand of SO the area of the Hungarian and Romanian holdings was, respectively: 95 and 115 hectares of UAA, while in the German, French and Spanish holdings it was within the range of 22-39 hectares of UAA. The analysed holdings to a varying extent used leased land whose share increased as the economic size of the holdings and was definitely larger in the holdings from the Western European countries. In the Polish and Hungarian holdings, in the classes of EUR 25-100 thousand of SO it was, respectively, 10 and 14%, while in the class of EUR 100-500 thousand of SO in the Hungarian and Romanian holdings it was about 60%, and in the French holdings – 88%.

10) Holdings from the first group had more labour resources. In the Polish and Hungarian holdings, in the classes of EUR 25-100 thousand of SO, labour resources were within the range of 3-4.4 AWU/holding, while in the German and French holdings: 1.9 and 1.8 AWU/holdings. In another class, labour resources in the Hungarian and Romanian holdings were about 10 AWU/holding and were more than twice higher than in the German, French and Spanish holdings. Also, in the holdings from the first group, the share of own labour in total inputs was lower than in the holdings from the second group.

11) Value of assets showed a downward trend as the economic size increased. In this case, there are no clear differences between the analysed groups of the holdings. By far, the highest value of assets occurred in the German and Italian holdings, in which it was within the range of EUR 36-51 thousand/hectare of UAA. In the remaining groups of the holdings, it was lower, ranging from EUR

4.6 (Romania) to 19.2 (Poland) thousand/ha of UAA. Assets were dominated by fixed assets, whose share decreased as the economic size of the holdings decreased. In most of the holdings, it was more than 80%, except for the French, Spanish and Italian holdings in which it was lower. Liabilities were dominated by own capital, which was more than 80%, with the exception of the French holdings in the class of EUR 100-500 thousand of SO in which it was 50%.

12) Organisation of production determined by the share of the area of orchards in UAA was similar in all the analysed holdings. The share of orchards in UAA exceeded 70%. The exception were the French holdings with the economic size of EUR 100-500 thousand of SO where the share of orchards amounted to 52%. The structure of production in all holdings was similar. It was dominated by crop production, whose share was more than 85%.

13) There were the differences in the production intensity level. Total costs per 1 ha of UAA in all holdings, except for the German and French holdings, was similar, ranging from EUR 1.5 thousand/ha (Hungary, Romania) to EUR 3.87 thousand/ha (Italy). In the German and French holdings, it ranged from EUR 6.84 to 8.96 thousand/ha and was more than two times higher than the costs in other holdings. The level of direct costs was less diversified. In the Romanian, Hungarian and Polish holdings, it did not exceed EUR 0.7 thousand/ha, while it was the highest in the German holdings, in which it was more than EUR 1.4 thousand/ha. Differences in costs of plant protection products were not significant. Costs of paid labour in the holdings of the Western European countries were two and even three times higher, within the range of EUR 1-2 thousand/ha, while in the Polish, Hungarian and Romanian holdings they did not exceed EUR 0.7 thousand/ha. Similar relationships occurred in case of costs of depreciation.

14) Land productivity determined by the production value per 1 ha of UAA in the Polish, Hungarian and Romanian holdings ranged from EUR 1.88 to 3.65 thousand/ha and was more than three times lower than in the German, French and Italian holdings, in which it ranged from EUR 9.4 to 25.21 thousand/ha. The level of diversification of assets productivity was lower. In the Polish, Hungarian, German, Italian and Spanish holdings, it was similar, ranging from 0.17 to 0.36. It was definitely higher only in the French holdings, in which it was 0.64 and 0.71. The current assets productivity in all holdings, except for the Italian and Spanish holdings, was similar, ranging from 1.23 to 2.78. In the Italian and Spanish holdings, it was 0.86 and 0.87. The labour productivity in the Polish, Hungarian and Romanian holdings ranged from EUR 17.82 to 27 thousand/AWU and was twice lower than in other countries.

15) Among the Polish vegetable-growing holdings, able to compete were only the holdings from the following economic size classes: EUR 50-100 and 100-

-500 thousand of SO. In case of the Hungarian holdings, able to compete were the holdings from the class of EUR 8-25 thousand of SO, while competitive were the holdings from the class of EUR 25-500 thousand of SO. Moreover, able to compete were also the Romanian holdings from the class of EUR 25-50 thousand of SO, German holdings from the classes of EUR 100-500, and 500 thousand of SO and more, French holdings from the class of EUR 100-500 thousand of SO and Italian and Spanish holdings from the class of EUR 500 thousand of SO and more.

16) Area of the Polish vegetable-growing holdings able to compete was about 8 and 10 ha of UAA and was two and three times less than that of the Hungarian holdings. However, it was two and three times larger than that of the German and French holdings. The Polish holdings used leased land to a lesser extent. Their share was about 17%, while in the Hungarian holdings it was more than two times higher, in the remaining holdings it was more than 50%.

17) Labour inputs in the Polish holdings amounted to 3.7 and 7.1 AWU/holdings and were lower than in the Hungarian holdings, but by about 50% higher than in the German and French holdings. The share of own labour in the class of EUR 100-500 thousand of SO in the Polish holdings amounted to 28% and was similar to the share of those inputs in the German and French holdings in which it amounted to, respectively: 34% and 32%. In the largest class, the share of own labour in the German, Italian and Spanish holdings was within the range of 10-15%.

18) The value of assets in the Polish holdings was higher than in the Hungarian holdings but lower than in the German and French holdings. The higher share of fixed assets in assets and of own capital in liabilities in the Polish holdings evidenced their lower flexibility in terms of adapting to the changes in the environment.

19) Scale of production of vegetables in the Polish holdings was lower than in other countries. This is evidenced by lower share of the cultivation area of vegetables in UAA.

20) The production intensity level in the Polish vegetable-growing holdings was lower than in the remaining holdings, especially German, French and Italian. The result of it was lower land productivity and labour productivity.

21) Polish, Hungarian and Romanian holdings obtained higher production profitability than the holdings from the Western European countries.



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# FRUIT AND VEGETABLE PRODUCER GROUPS AND ORGANISATIONS AS A METHOD OF IMPROVING THE COMPETITIVE POSITION OF FRUIT GROWERS IN POLAND

## Introduction

Production and export successes of Polish fruit producers which have continued in the recent years despite the adverse external conditions, such as the Russian embargo of 2014<sup>36</sup>, inspire to seek sources of competitive advantages of individual entities and the entire sector. One of the ways to increase the bargaining power of agricultural producers in the market are the horizontal integration activities consisting in merging entities of the same level in the marketing chain<sup>37</sup>. With regard to the fruit sector, individual fruit growers may, on a basis of an agreement, merge their production and economic potential into a single entity, referred to as a producer group or organisation<sup>38</sup>. This allows to use the economies of scale, reduce transaction costs and implement marketing functions going beyond the capacity of a single producer<sup>39</sup>. On the meso- and macroeconomic scale, the integrated supply enables better coordination of the entire supply chain – it allows to plan the quantity and quality of products, reduces the information asymmetry in the market, leads to a reduction in transaction costs, and, consequently, contributes to the greater price stability<sup>40</sup> and better adjustment of products to the needs of the final customer<sup>41</sup>.

For the Polish fruit growers, the past decade was a period of intensive building of cooperation structures. The objective of the study is to evaluate the production potential and marketing policy of the fruit producer organisations which are important determinants of the possibilities of improvement of the competitiveness of the fruit growers forming these groups. In this context, the

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<sup>36</sup> The Russian Federation imposed the embargo, *inter alia*, on the import of the following goods: fresh, dried and frozen fruit; fresh, dried and frozen vegetables, excluding potato seedlings, spring onions, sugar maize for sowing and peas for sowing.

<sup>37</sup> A. Woś, *Encyklopedia biznesu*, Vol. 2, entry *Rolnictwo jako dziedzina biznesu*, Fundacja innowacja 1995, pp. 796-801.

<sup>38</sup> J. Małyś, *Procesy integracyjne w agrobiznesie*, Centrum Doradztwa i Edukacji w Rolnictwie w Poznaniu, Poznań 1996, pp. 13-15.

<sup>39</sup> A. Chlebicka (2011), *Czynniki wpływające na sukces grup producentów rolnych*, J. Agribus. Rural Dev. 22 (4), pp. 31-39.

<sup>40</sup> A. Chlebicka, J. Fałkowski, T. Wołek (2009), *Powstawanie grup producenckich a zmienność cen*, *Zagadnienia Ekonomiki Rolnej*, No. 2, pp. 59-71.

<sup>41</sup> K. Herck (2014), *Assessing efficiencies generated by agricultural Producer Organisations*, European Commission, Brussels.

past decade of the development of horticultural groups in Poland was summarised, indicating the regional specificity of this process (first subchapter) and the available forms of support for establishing and functioning of these entities (second subchapter). In the basic part of the study, we evaluated the production potential and structure of the producer organisations, sales value and product range as well as sales channels. The results of the study were supplemented by a qualitative analysis regarding the rules of functioning of the producer organisations and the membership policy they apply. The latter may in the future determine the scale of popularisation of the group form of management in horticulture. The study ends with the conclusions as regards the development prospects for the fruit producer organisations in Poland.

### **Methodology of research**

The study uses both the secondary data from the lists of the fruit and vegetable producer organisations and groups published until 2014 by the Ministry of Agriculture and Rural Development and, as from 2015, by the Agricultural Market Agency (AMA) and the unpublished data on the producer organisations functioning in 2014, provided by the Agricultural Market Agency. The literature review and analysis of the secondary data were supplemented by the results of own research, conducted in 2015 among the management representatives of the producer organisations involved in fruit production and sale, from the Mazowieckie and Łódzkie Voivodeships. The research sample covered 18 entities (14 producer organisations located in the Mazowieckie Voivodeship, and 4 in the Łódzkie Voivodeship), which have been under scientific observation since 2007<sup>42</sup>. The data were collected partially by means of a structured in-depth interview and on a basis of the documents provided by the organisations (membership agreements, statutes, recognition plans, operational programmes)<sup>43</sup>. Due to the availability of data (own research, unpublished AMA research), most deliberations were conducted in relation to the year 2014. Where it was possible, the most recent data, i.e. for 2015, were presented. The data analysis, applies the methods of descriptive statistics.

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<sup>42</sup> The analysed sample in terms of the size accounted for 28% of the producer organisations operating in Poland in 2014 and 9% of all entities bringing together fruit growers (PO and PG) at that time.

<sup>43</sup> In case of 5 entities, research was carried out as part of the theses prepared at the Faculty of Economic Sciences – Warsaw University of Life Sciences.

## Horizontal integration of fruit producers in Poland

At the end of 2015, there were 305 groups and organisations bringing together fruit and vegetable producers in Poland<sup>44</sup>. Those entities, depending on the recognition status or preliminary recognition status granted based on meeting of criteria specified by law, were called the preliminary recognised fruit and vegetable producer groups (PG) or the recognised fruit and vegetable producer groups, i.e., the producer organisations (PO). Both groups and organisations rely on cooperation of fruit growers at the stage of production and marketing, which is manifested in the concentration of supply, application of uniform production standards and conducting joint sale and trade policy. The division of the nomenclature into the PG and PO results from the EU nomenclature, according to which the producer organisations are legal entities that have been created on the initiative of producers, have at least 5 members, generate the minimum value of PLN 500 of marketable production and strive for achieving at least one of the following objectives:

- ensuring planning and adjusting production to demand, in particular with respect to quality and quantity;
- concentration of supplies and marketing of products produced by their members;
- optimisation of production costs and profits from investments, for the maintenance of the environmental protection standards as well as stabilisation of producer prices<sup>45</sup>.

In contrast, the preliminarily recognised producer groups are entities which have not yet met the requirements governing the producer organisation but ultimately would like to receive this status. The status of preliminary recognition and the implementation of the recognition plan, therefore, are aimed at making the group meet the full recognition requirements within the

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<sup>44</sup> The register kept by the Agricultural Market Agency, at the end of 2015 includes 341 entities bringing together fruit and vegetable producers, however, in case of 36 groups recognition or preliminary recognition was revoked and, thus, they do not receive public support.

<sup>45</sup> The provisions of the Regulation No. 1308/2013 allow the Member States to recognise producer organisations, associations of producer organisations and interbranch organisations. Recognition of producer organisations is compulsory in the sectors of fruit and vegetables, hops, milk and milk products. It is also compulsory to recognise interbranch organisations in the tobacco sector. Recognition lies within the competence of the Agricultural Market Agency.

framework of the common organisation of the market in fruit and vegetables<sup>46</sup>. The producer groups and organisations are subject to various kinds of support under the Common Agricultural Policy<sup>47</sup>.

The process of creating horticultural groups started in Poland after 2004<sup>48</sup>, along with the possibility to obtain support within the framework of the common organisation of the market in fruit and vegetables<sup>49</sup> and the previously adopted act which had created a legal framework for the horizontal integration of farmers in Poland<sup>50</sup>. Most new entities (slightly more than half) were established in 2009-2011. In 2015, there were a total of 305 fruit and vegetable producer groups and organisations in Poland. Those entities were dominated by the producer organisations – 195, which had 5,336 members. In case of Poland, they are mostly entities which were established before 2011 and implemented their recognition plan as the preliminarily recognised producer groups. Currently, the preliminarily recognised fruit and vegetable producer groups, which in a number of 110 have 1,140 members, remain in minority.

When comparing the level of organisation of the fruit and vegetable market to other markets, it must be concluded that the fruit growers so far have shown the greatest initiative in the field of cooperation within the producer groups. For comparison: in 2001-2015 1,295 agricultural producer groups (APG) were established. This means that the number of the horticultural groups (305) accounts for almost a quarter of the APG community.

Among the fruit and vegetable producer groups and organisations, the number of entities authorised to produce and sell fruit was 204, of which 144 (about 71%) were the producer organisations, and the remaining 60 were the

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<sup>46</sup> Granting the preliminary recognition status could be applied for those producer groups which were not able to meet all the conditions for full recognition referred to in Article 122, Article 125a, Article 125b of the Council Regulation (EC) No. 1234/2007, Title III, Chapter i, Section 2 of the Commission Regulation (EC) No. 1580/2007 and Article 3 of the Regulation of the Minister of Agriculture and Rural Development of 16 December 2008 on the conditions for preliminary recognition of fruit and vegetable producer groups, recognition of fruit and vegetable producer organisations as well as the conditions and requirements to be met by recognition plans.

<sup>47</sup> More on the EU and national regulations regarding PGs and POs by 2010 in the *ABC organizowania i funkcjonowania grup producenckich*, Centrum Doradztwa Rolniczego, Radom, 2010.

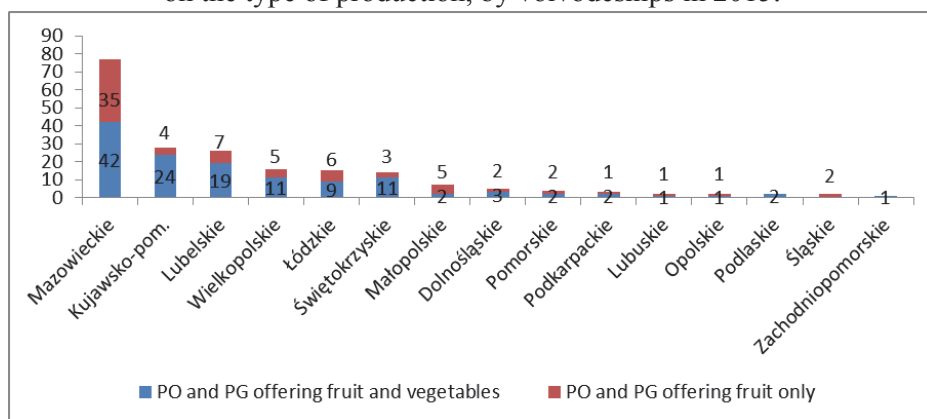
<sup>48</sup> In fact, the register referred to above includes the information about one group, which was established in 2002, but due to the fact that it has been removed from the register, it is not included in Figure 1.

<sup>49</sup> Act of 19 December 2003 on the organisation of the market in fruit and vegetables, hops market, tobacco market and dried fodder market (Journal of Laws No. 223 of 2003, item 2221).

<sup>50</sup> Act of 15 September 2000 on the agricultural producer groups and their associations (Journal of Laws 2000, No. 88).

preliminarily recognised groups. Most of those entities registered their activities in the area of production and marketing of fruit and vegetables (131 entities), and the remaining PGs and POs specialised in marketing of only fruit (73 entities). The number of entities bringing together the fruit growers due to the type of production by voivodeships is shown in Figure 1.

Figure 1. The number of fruit producer organisations and groups depending on the type of production, by voivodeships in 2015.



Source: own study based on the AMA data.

The distribution of the fruit producer organisations and groups is diversified regionally – most entities (more than 20) were established in the Mazowieckie, Kujawsko-Pomorskie, Lubelskie Voivodeships while more than ten entities operate in the Wielkopolskie, Łódzkie and Świętokrzyskie Voivodeships. This location corresponds to the concentration of fruit production across the country, especially with regard to production of tree fruit, as shown in Table 1<sup>51</sup>.

The fruit grower groups and organisations had 6.7 thousand members in total, of which 5.2 thousand were the producer organisations and 1.5 thousand – the preliminarily recognised groups. The fruit grower producer organisations were larger in terms of the number of members than the preliminarily recognised groups – the average number of members of the POs is 36 compared to 25 for the PGs. In case of the producer organisations, half of entities had more than 23 members, while half of the preliminarily recognised groups had less than 9 members. 11 POs and 2 PGs associated more than 100 fruit growers.

<sup>51</sup> According to the representative study of the orchards carried out in 2012 by the CSO, the cultivation of apple trees in the orchards was concentrated mainly in the Mazowieckie Voivodeship (42.4% of the orchard area occupied for the cultivation of apple trees in Poland). The large concentration of apple orchards was also recorded in the following voivodeships: Łódzkie (12.2%), Lubelskie (11.1%) and Świętokrzyskie (10.6%). In total, in these four voivodeships there were 76.3% of apple orchards in Poland.

Table 1. The number of fruit producer organisations and groups according to the concentration of fruit production, by voivodeships in 2015

Specification	Yields				Number of POs and PGs selling fruit	
	Tree fruit		Fruit from fruit bushes and berry plantations			
	in thousand tonnes	% of domestic production	in thousand tonnes	in thousand tonnes	POs and PGs	%
Poland	3852	100	518	100	204	100
Mazowieckie	1609	44.9	84	16.2	77	38
Lubelskie	546	15.3	220	42.4	26	13
Łódzkie	437	12.2	47	9.1	15	7
Świętokrzyskie	474	13.2	28	5.3	14	7
Wielkopolskie	121	3.4	15	2.9	16	8
Kujawsko-Pomorskie	66	1.9	12	2.4	28	14
Małopolskie	125	3.5	18	3.5	7	3
Dolnośląskie	32	0.9	11	2.1	5	2
Pomorskie	20	0.5	8	1.6	4	2
Podkarpackie	40	1.1	14	2.8	3	1
Lubuskie	30	0.8	14	2.6	2	1
Zachodniopomorskie	34	1	18	3.4	1	0
Warmińsko-Mazurskie	18	0.5	16	3	0	0
Śląskie	8	0.2	4	0.9	2	1
Podlaskie	15	0.4	8	1.6	2	1
Opolskie	6	0.2	2	0.3	2	1

Source: own study based on the CSO (yields) and AMA (number of PGs and POs).

### Principles of support for fruit producer groups and organisations

From 1 May 2004 to 31 December 2007, the preliminarily recognised fruit and vegetable producer groups could receive financial aid to cover the costs associated with establishing the group and pursuing the administrative activity. Support was paid according to a flat rate calculated on the annual sale revenue value. The rate in the individual years of the implementation of the plan was, respectively, 5%, 5%, 4%, 3% and 2% of the value of marketed production not exceeding EUR 1 million or, respectively, 2.5%, 2.5%, 2%, 1.5% and 1.5% of the value of marketed production exceeding EUR 1 million. The upper value of aid could not exceed EUR 100 thousand in the first and second year, EUR 80 thousand in the third year, EUR 60 thousand in the fourth year and EUR 50 thousand in the fifth year of implementing the recognition plan.

From 1 January 2008, the reform of the EU common organisation of the markets in fruit and vegetables was implemented, under which support

addressed to the fruit and vegetable producer groups was increased<sup>52</sup>. The amount of financial aid granted based on a flat rate was increased to, respectively: 10%, 10%, 8%, 6% and 4% of the value of marketed products up to EUR 1 million and 5%, 5%, 4%, 3% and 2% of the value of marketed products exceeding EUR 1 million. The annual limit of aid for individual groups was changed to EUR 100 thousand for five years.

At the same time, from February 2006, the preliminarily recognised fruit and vegetable producer groups could receive financial aid to cover a part of the eligible investment costs associated with harvesting, storage or preparation of fruit and vegetables for sale, as included in the approved recognition plan. Aid was granted according to the very attractive conditions, as an investment could be co-financed up to 75% of the eligible costs incurred. Thanks to this co-financing, most groups built modern cold stores, purchased new technological lines, thus reaching the same high standards as regards preparing products for marketing.

In 2012, the European Commission issued the Implementing Regulation No. 302/2012 limiting aid for the preliminarily recognised fruit and vegetable producer groups to the amount of EUR 10 million a year for the new Member States. From 2014, new entities may use (like other APGs) the measure *Creating agricultural producer groups and organisations*, for which PLN 1.7 billion were allocated under the programme. In addition, the groups may be beneficiaries of the RDP measures for modernisation of agriculture and the food industry, especially the measure *Support for investment in the processing, marketing or developing agricultural products*<sup>53</sup>.

Support for the integration activities in the horticultural sector in the EU financial perspective for 2014-2020 has not changed much in case of the POs. The producer organisations still will be able to use co-financing from the operational fund<sup>54</sup>, under which the operational programme is implemented<sup>55</sup>

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<sup>52</sup> T. Filipiak (2013), *Uwarunkowania prawno-organizacyjne sektora owoców i warzyw w Polsce*, Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu, Vol. 15, issue 5, pp. 63-69.

<sup>53</sup> Eligible costs include, *inter alia*, costs of construction and modernisation of production or warehouse buildings, investments in the purchase of machinery and equipment or infrastructure to protect the environment, costs of purchasing machinery or devices for processing, storage or preparing products for sale, devices to improve the environmental protection, costs of purchasing software for business management and control of the production and storage process. The level of aid will amount to a maximum of 50% of the costs of an investment eligible for support. The maximum amount of aid under the submeasure granted during the implementation of the programme to one beneficiary is PLN 3 million, and in case of agricultural producer group unions or producer organisation associations – PLN 15 million.

<sup>54</sup> This is a separate bank account created only to support financial operations related to the implementation of the operational programme. This means that all expenses incurred by



that contains the measures to improve marketing, quality of fruit and vegetables, production planning and environmental protection<sup>56</sup>. The operational fund may be supported in three ways: contributions from the organisation members (fruit and vegetable producers), contribution made directly by the organisation and financial aid from the European Union. The EU financial aid consists in co-financing expenses incurred from the operational fund for the implementation of projects approved in the operational programme<sup>57</sup> and shall be subject to the limits laid down in this regulation. Aid may amount to 4.1% of the value of production marketed by the given producer organisation or 4.6%, in the situation when the organisation implements crisis management measures. This support is limited to 60% of the operational fund established by an organisation. According to the AMA data, in total 16 recognised fruit and vegetable producer organisations are authorised to implement the operational programmes in 2016. The approved amount of support for these funds with public resources for 2016 will be PLN 17 million<sup>58</sup>.

An important tool available to the member producers of the fruit and vegetable producer organisations so as to protect their income in case of unexpected price fluctuations during the crisis, are the so-called crisis management and crisis prevention measures. In Poland, a recall mechanism has been implemented, which consists in providing, through the producer organisation, of recalled fruit and vegetables for the so-called free distribution or for other purposes. The producer organisation implementing the recall mechanism may apply for the payment of compensation provided for by the EU legislation.

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the organisation under the programme and to which it wants to receive co-financing, must be incurred directly from the operational fund account.

<sup>55</sup> The operational programme will be approved for a period of from 3 to 5 years and implemented in annual periods, lasting from 1 January to 31 December of each year.

<sup>56</sup> The recognised fruit and vegetable producer organisation must implement under the operational programme at least two out of the objectives specified in the “Strategia krajowa dla zrównoważonych programów operacyjnych organizacji producentów owoców i warzyw w Polsce na lata 2010-2016” [*National strategy for sustainable operational programmes of fruit and vegetable producer organisations in Poland for 2010-2016*].

<sup>57</sup> According to the rules laid down in the Regulation of the European Parliament and of the Council (EU) No. 1308/2013.

<sup>58</sup> *Sprawozdanie z działalności Agencji Rynku Rolnego w 2015 r. (2016 r.)*, Agencja Rynku Rolnego, Warsaw.



## Fruit producer organisations in Poland – production and economic potential and marketing policy in 2014<sup>59</sup>

In 2014, 65 fruit producer organisations had in total 2,640 members. The members of those organisations were mostly natural persons, nevertheless, in case of four POs their members were also legal persons. Most fruit grower organisations functioned in the Mazowieckie (28), Lubelskie (13) and Łódzkie and Małopolskie Voivodeships – 6 POs in each. They differed as to the number of their members – the largest, in terms of membership, were the POs from the Małopolskie and Lubelskie Voivodeships which had, on average, 70 and 71 member producers, respectively. The average number of the organisation members was 41 producers. On the other hand, most producers were the members of the POs from the Lubelskie, Mazowieckie and Małopolskie Voivodeships (Table 2).

Table 2. Fruit producer organisations – legal form and the number of members by voivodeships (2014)

Voivodeship	Number of POs	Companies	Associations	Cooperatives	Number of PO members	Average number of PO members
Mazowieckie	28	24	1	3	898	32
Lubuskie	1	0	1	0	16	16
Pomorskie	2	1	1	0	31	16
Świętokrzyskie	3	1	0	2	152	51
Dolnośląskie	1	1	0	0	20	20
Kujawsko-Pomorskie	2	2	0	0	10	5
Małopolskie	6	3	1	2	469	78
Łódzkie	6	4	1	1	68	11
Lubelskie	13	6	7	0	911	70
Wielkopolskie	3	1	1	1	65	22
Total	65	43	13	9	2640	41

*Source: own study based on the unpublished AMA data.*

All fruit grower organisations were created in 2003-2011 and most of them (88%) were established in 2005-2009. The fruit growers in the vast majority chose limited liability companies as a legal form of group activity (43 entities), less popular were associations (13 entities) and cooperatives (9 entities) (Table 2). Depending on the adopted legal form, the POs differed in terms of the number of members – the smallest were cooperatives with the average number of members

<sup>59</sup> The presented analysis applies to 65 fruit grower organisations that in 2014 were recognised producer organisations, which represents almost half (45%) of the fruit grower POs operating at the end of the 2015 and one-third (32%) of the community of all POs and PGs operating in 2015.

amounting to 24, larger were limited liability companies bringing together, on average, 37 producers and associations – 60 members.

The cultivation area of the fruit growers being the organisation members amounted to, in total, 18.7 thousand ha, of which fruit were cultivated on 17.5 thousand ha, and vegetables on about 1 thousand ha. Among cultivated fruit, dominant were permanent crops, which occupied 94% of the fruit cultivation area<sup>60</sup>, and the remaining 6% were temporary fruit crops in open air<sup>61</sup> (Table 3). In case of 33 POs, only permanent crops were recorded, five POs had only temporary crops, while the remaining 27 entities brought together producers of tree fruit and berries.

Table 3. The area of crops in orchards of producers being PO members, by products (in 2014)

Specification	Cultivation area in ha	% share in the total cultivation area in POs
fruit, including:	17,553	94
<i>permanent crops</i>	15,977	86
<i>temporary crops in open air</i>	1,571	8
<i>temporary protected crops</i>	5	0
vegetables, including:	1,131	6
<i>field</i>	1,127	6
<i>protected</i>	4	0
Total	18,684	100

Source: own study based on the unpublished AMA data.

The share of the cultivation area in the orchards belonging to the PO members amounted to 6% of total fruit production in the voivodeships, where the analysed entities operated and 5% of the national fruit cultivation area. The largest share of fruit crops by voivodeships was that of the PO member fruit growers in the Małopolskie, Pomorskie, Mazowieckie and Lubelskie Voivodeships – more than 5% of the voivodeship fruit cultivation area (Table 4).

<sup>60</sup> Permanent crops, in accordance with point G, Annex I to the Commission Regulation (EC) No. 1444/2002, i.e. crops not subject to crop rotation and other than permanent grassland, occupying the land for a long period and yielding for several years; they include orchards and other clusters of fruit trees.

<sup>61</sup> All annual and several years' crops of fruit in open air; they include plantations of fruit bushes (raspberries, blackberries, mulberries and raspberry/blackberry hybrids, black, white and red currants, gooseberries, cranberries, blueberries and other fruit of *Vaccinium* species), vineyards (table grapes), plantations of crops of *Actinidia* species and perennial crops (strawberries, rhubarb, etc.); in the analysed entities, also the protected cultivation of strawberries (in tunnels) with a total surface area of 5 ha.

The largest area of the orchards operated by the PO member producers was recorded in the Mazowieckie Voivodeship (46% of the total area of orchards in PO). The average cultivation area per producer was 6.6 ha, whereas the statistically largest orchards belonged to the PO members from the Kujawsko-Pomorskie (29.3 ha), Pomorskie (16.8 ha) and Łódzkie (15 ha) Voivodeships and the smallest – to the producers from the Lubuskie (2.1 ha), Świętokrzyskie (5.1 ha) and Lubelskie (5.2 ha) Voivodeships. The average fruit cultivation areas in the Mazowieckie Voivodeship, which is a leader in terms of production and the number of the PO members, was 9 ha.

Table 4. The area of crops in orchards of producers being PO members, in 2014, by voivodeships

Voivodeship	Fruit cultivation area (ha)	Cultivation area of PO members (ha)			Share of the cultivation area of PO members in the cultivation area
		fruit and vegetables	fruit	vegetables	%
TOTAL	294,517.49	19,289.65	17,553.46	1,736.19	6
Mazowieckie	103,194.57	8,108.51	8,051.21	57.3	8
Lubelskie	69,865.52	5,299.99	4,695.52	604.47	7
Małopolskie	11,620.10	1,350.11	1,350.11	0	12
Łódzkie	35,255.82	1,629.14	1,021.64	607.5	3
Świętokrzyskie	36,589.22	808.55	780.52	28.03	2
Wielkopolskie	16,263.31	556.59	556.59	0	3
Pomorskie	4,204.22	519.26	519.26	0	12
Kujawsko-Pomorskie	8,875.48	732	293.11	438.89	3
Dolnośląskie	4,809.18	252	252	0	5
Lubuskie	3,840.06	33.5	33.5	0	1

Source: fruit cultivation area by voivodeships based on CSO: production of agricultural and horticultural crops in 2015; cultivation area of PO members by voivodeships based on the unpublished AMA data.

In 2014, the fruit and vegetable producer organisations placed on the market products with a value of about PLN 536 million, of which about 70% accounted for the sale of products produced by the PO members and the remaining 30% were generated by the sale of products purchased from the PO non-members. The highest sale was generated by the POs from the Mazowieckie (60%), Lubelskie (14%) and Łódzkie (11%) Voivodeships. The average sales level per PO amounted to PLN 8.2 million. The sale ranged from about PLN 100 thousand to PLN 37 million, and half of entities had the sales level higher than

PLN 6.2 million. Per one member producer, the sales value (concerning production of the PO members) was, on average, PLN 140 thousand and was the highest in case of the POs from the Kujawsko-Pomorskie and Łódzkie Voivodeships, while the lowest – in case of the Dolnośląskie and Małopolskie Voivodeships.

Table 5. The value of products sold by PO, (fresh and processed) in PLN thousand in 2014

Specification	Mazowieckie	Lubelskie	Łódzkie	Małopolskie	Kujawsko-Pom.	Świętokrzyskie	Pomorskie	Lubuskie	Dolnośląskie	Total
Value of products sold by PO (fresh and processed) in total	321,480	77,641	61,578	28,289	14,751	11,230	7,339	4,201	976	535,893
of which those produced by the given PO/ APO members	214,256	56,415	42,538	19,143	12,232	9,168	6,857	4,201	562	370,585
Average total sales volume per PO	11,481	5,972	10,263	4,715	7,375	3,743	3,670	4,201	976	8,245
Average sales volume of productions of member producers per 1 PO member	239	62	626	41	1,223	60	221	263	28	140

Source: own study based on the unpublished AMA data.

The range of goods of the producer organisations was dominated by tree fruit, mainly apples, with the share of 84%. Pears accounted for about 21% of sale, sour cherries and cherries – 3.5%, plums and sloes – 1.2%. From among berries, the most important in the PO sale were raspberries (and blackberries and mulberries included in the same category) with the share of 3% in sale, cranberries, blueberries, and other fruit of *Vaccinium* species<sup>62</sup> (2.4%) as well as strawberries (1.7%)<sup>63</sup>.

The fruit growers organisations showed a high degree of specialisation. The share of the most important product category in terms of the share in the sale was as much as 87%, and of two leading categories – 95% in total. Most

<sup>62</sup> This category in Poland was dominated by northern highbush blueberries and currants.

<sup>63</sup> Own study based on the unpublished AMA data.

POs specialised in production of apples, which constituted the most important product category in the sale of as many as 50 entities. Only 11 POs specialised in production of berries – for five entities, the most important product sold were strawberries, for another five – raspberries and for one – northern highbush blueberries. In the remaining four cases, sour cherries and cherries were in the lead, on equal terms with apples<sup>64</sup>.

The most important distribution channel was wholesale trade implemented with wholesalers, logistic departments of retail chains and wholesale market (PLN 240.8 million, 45% of sale). A significant part of the sale was implemented by means of direct transactions with supermarkets and multiple stores – 21%. Some fruit were also exported (16% of PO sale) and sold to retailers not belonging to retail chains (2%). It is worth adding here that the achieved result of PLN 87.5 million by way of direct export accounted for about 15% of the national export of fruit and was burdened with the extremely adverse external conditions in foreign trade<sup>65</sup>. Some organisations (six entities) processed fruit produced in orchards of their members. Processing consisted in freezing (strawberries) and production of juices (various fruit). The sales value of products processed by the POs accounted for about 1% of total sale.

In total, the sale of fresh products accounted for 83% of the sale. The remainder of the sale consisted in deliveries of products to processing plants (16%). The producer organisations also made use of compensation for recalling products from the market, which accounted for 1% of the sale – PLN 0.7 million of compensation for products recalled from the market for free distribution and PLN 3.6 million of other compensation<sup>66</sup>. Compensation was paid in connection with establishing provisional extraordinary support measures for the producers of certain fruit and vegetables in the situation of crisis resulting from the fact that in August 2014 the Russian Federation introduced a ban on the import of

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<sup>64</sup> Own study based on the unpublished AMA data.

<sup>65</sup> Pursuant to the CSO data in 2014, there was a considerable reduction in the national export of fresh fruit – when compared to the previous year, i.e. by about 12% (the export volume of fresh fruit in 2014 amounted to 1,334 thousand tonnes). The reduction in the fruit export resulted mainly from the 16% decrease in the export to the CIS, especially to the Russian Federation, which prior to the imposition of the embargo was the main recipient of Polish fruit. The dominant position in the Polish export of fruit are apples – 402,000 tonnes of apples were exported to Russia, by 41% less than in 2013.

<sup>66</sup> Financial support from the EU budget was granted to the producers due to the recall of fruit and vegetables from the market for free distribution or for other purposes. Other purposes were defined as: provision as feed for animals in agricultural holdings, zoological gardens, national and landscape parks, nature reserves and in hunting districts; provision of products to the entity managing a biogas plant for energy purposes or activities in the field of processing agricultural products for alcohol used solely for industrial or energy purposes; so-called green harvesting or non-harvesting of crops.

certain EU agri-food products<sup>67</sup>. When it comes to fruit, financial support in Poland covered the following products intended for human consumption as fresh products: apples, pears, plums, soft fruit (raspberries and blackberries, black currants, white currants, red currants, gooseberries) and table grapes.

### Costs and benefits of the PO membership

An analysis of the contents of the membership agreements concluded by the analysed producer organisations allowed to identify the formalised rules of cooperation of the fruit growers. The most important rights and responsibilities of the PO members are presented in Table 6.

Table 6. Rules of cooperation of fruit growers in the analysed fruit grower organisations

Rights of the PO members	Responsibilities of the PO members
receiving payment for products supplied to the PO in a specific manner	belonging to one fruit and vegetable producer group with the status of the preliminary recognised or recognised organisation
using machinery, equipment and resources being the joint property of the organisation	providing the organisation with a specific quantity of production produced in the holding
using assistance in order to obtain necessary means of production	observing the quality requirements regarding products provided to the PO
right to control the activities of the group	observing the established methods of cultivation and environmental protection
right to participate in training courses organised by the group	submitting documents to the group for statistical purposes
right to co-decide in case of decisions exceeding regular management	paying for services provided by the group to the member in the manner adopted by the PO
right to terminate the membership in writing while providing the reasons for the termination	making contributions to the operational fund

Source: own study based on the content of POs agreements and statutes.

The producer may be a member of only one producer organisation with regard to products for which this entity has been granted the recognition status. The organisation member may sell outside the organisation to a very limited extent – not more than 20% of the sales volume in case of an organisation recognised for one product or 25% in case of an organisation recognised for two or more product groups. This sale may be made only to consumers for their

<sup>67</sup> Commission Delegated Regulation (EU) No. 932/2014 of 29 August 2014 laying down temporary exceptional support measures for producers of certain fruit and vegetables and amending Delegated Regulation (EU) No. 913/2014.

personal needs (final consumer), which prevents selling to another producer organisation, processor or retail chain without PO. The membership agreements of all analysed entities specified the volume of production supplied by the members – the fruit growers indicated what part of their production would be left at the disposal of the group or obliged themselves to deliver a specific quantity to the group.

The prices of table apples achieved by the producers supplying their products to the producer organisations in 2014 (for 7 months) were slightly higher than the average buying-in price for the Mazowieckie Voivodeship (by PLN 0.16, i.e. by 15%) and almost at the same level as the national average procurement price of apples (Table 7). The level of the prices of table apples in individual transactions was determined by: variety, size and colour of apples. In the settlements with the PO members and with the non-member fruit growers, the producer organisations charged, depending on the terms of the transaction, fees for transport, storage, sorting, packing. The operating fees charged to the members for services provided for their benefit ranged from 2% to 10% of the price of products sold through the organisation. What is important, the operating fees charged to the members were, on average, almost half lower than the fees for the same services provided to the PO non-members supplying products to the PO. The settlements between the PO and the suppliers were made within 60 days.

Table 7. Average prices of table apples in the analysed entities in comparison to procurement prices and wholesale market prices

Average prices of table apples	I	II	III	IX	X	XI	XII	average for 7* months
analysed POs	1.34	1.4	1.65	0.75	0.70	0.75	0.85	1.06
Buying-in – Mazowieckie Voivodeship	1.48	1.37	1.05	0.53	0.54	0.64	0.66	0.90
Buying-in – national average	1.38	1.28	1.31	0.83	0.72	0.73	0.77	1.00

\* prices for 7 months due to the availability of data from the PO

Source: own study based on research (average monthly prices of table apples in the analysed POs) and on weekly market quotations published by the Ministry of Agriculture and Rural Development (buying-in prices).

All agreements included a definition of the method of making settlements for products supplied by the members, and of paying for the services provided by the group to the member. In some cases, the statute included a provision on the privilege of priority to selling products manufactured by the member through the group. The conditions under which this priority was implemented were specified by the meeting of shareholders (applies to limited liability companies).



The producer organisation members were required to observe the common rules regarding the methods of cultivation and environmental protection, as established in production plans, PO guidelines with regard to the methods of cultivation and environmental protection or implemented as a result of less formalised arrangements. Production planning was by far more formalised in case of the PO implementing operational programmes (6 from among the analysed POs). The fruit growers also undertook to supply fruit and vegetables in accordance with the adopted quality standards provided for all members. In addition, the PO members had information responsibilities – the producers were required to submit data on holdings, concerning, in particular, cultivation areas, yields, harvest of individual varieties of fruit and vegetables, as well as the sale volume and prices obtained for fruit and vegetables, which were the subject of direct sale implemented individually by the fruit grower.

The member producers had the right to use machinery, equipment and resources being at disposal of the groups as well as assistance in order to obtain necessary means of production. In case of using machinery and equipment, it was mainly about the possibility to use warehouses, cold stores, sorting machines and packing machines as well as means of transport belonging to the group. The fruit growers were also required to promote investment activities of the entities to which they belonged – in case of creating or supporting the existing operational fund, the members were required to bring a specified fee.

All entities organised joint purchases of means of production and were granted discounts from the purchase amount of 5-15%. The organisations also purchased equipment for the holdings of the fruit growers – in most cases, machinery and equipment became the ownership of the PO members, sometimes, they were handed over to the PO members on the principle of lending for use. In addition, in selected cases, the member producers had the right to use legal and organisational assistance of the group.

In all PO, training courses for the members were conducted which, in particular, focused on product quality systems, plant protection products, crop irrigation systems. Eight entities employed persons as agricultural advisor/horticulture production engineer supervising the crops of the member producers.

The analysed organisations functioned mostly as limited liability companies (17 entities), and only one was a cooperative. The decision-making process in the PO, according to the management representatives, was based on joint decision-making by the members, however, the impact of the individual members was different depending on the number of shares held by the producer.

Should the producer fail to comply with its obligations under the membership agreement, the penalties were envisaged, which most often



included: warnings, temporary refusal to receive fruit and vegetables, fine or, as a last resort, forced redemption of shares. What is interesting, in none of the analysed organisations, despite problems with meeting the contractual obligations by the members, the provisions relating to penalties were entered into force. In turn, the member producers had the right to control the organisation bodies on the principles laid down by the regulations governing the functioning of the competent legal persons. In addition, the PO members could terminate their membership in writing, while providing the reasons for the termination, with the terms of notice provided for by law<sup>68</sup>. Here, it is worth stressing that the producer who left the fruit and vegetable producer organisation may not join the preliminarily recognised fruit and vegetable producer groups with regard to products for which the given producer organisation has been recognised, before the lapse of five years from the date on which the period of notice expires.

The PO approach to extending the membership may be assessed taking into account the manner in which the requirements for potential shareholders are formulated. During the recognition period, in most cases, the membership criteria for the producer were informal and included the knowledge of the producer due to family or friendship ties as well as previous informal cooperation. Currently, the membership requirements which are most often mentioned in PO statutes include:

- minimum production volume, which the candidate is able to provide at the group's disposal or the minimum cultivation area;
- cultivation of specific varieties (the requirements related to producers of apples);
- production of fruit and vegetables in accordance with the adopted quality standards which are provided for all members (this applies mainly to the GlobalGap certificate and IPO – Integrated Fruit Production);
- obligation of cooperation before joining the group (at least the year-long sale through it, cooperation resolved positively in the management's opinion).

From among the analysed entities, only four did not plan to increase the volume of products offered in the market. The remaining organisations intended to enlarge the sales volume, mostly due to increasing production by the existing members (half of the groups), as well as through the purchase of products from

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<sup>68</sup> Regulation of the Minister of Agriculture and Rural Development of 6 May 2011 on the termination of membership in the fruit and vegetable producer organisation and on the period for which the producer leaving the fruit and vegetable producer organisation will not be able to join the preliminarily recognised fruit and vegetable producer group (Journal of Laws of 2011, No. 105, item 619).

non-member producers (less than half of the groups) and the admission of new members (5 groups). The intention to enlarge the volume of products offered in the market involved the plans to extend the product range, as made by 61% of the analysed PO. Investment plans in the perspective by 2020 were held by half of the analysed organisations. At the time of research, the operational programmes were implemented only by 5 POs, however, the remaining organisations declared their interest in that form of support in the near future.

The existing implementation of the operational programmes consisted in implementing the measures related to production planning, environmental protection and improving or maintaining the quality of the product (the order according to the level of inputs). As part of better production planning, the PO received co-financing for the measures related to the implementation of technologies preventing the yield declines, e.g. purchase of installations of systems for irrigation of crops in the members' orchards. The companies also purchased computer software to control climate, phytopathological and entomological conditions in production of fruit and vegetables, as well as software to exchange data in the production planning and organisation process between the individual group members and between the members and the group. In turn, within the framework of implementing the objective as regards improving or maintaining the quality of the product, installations were mounted to protect fruit trees and bushes against hail, excessive rain or birds. The organisations also started making investments in the field of the environmental protection, which are aimed at reducing the energy consumption.

Table 8. Objectives of the POs for the future (by 2020)

Objectives of the POs for the future	Percentage of POs
enlarging the volume of offered products by increasing production by the existing members	50
enlarging the volume of offered products through buying-in from outside the PO (1) and (2)	44
admission of new members	10
enlarging the product range	28
investments in fixed assets	61
implementation of the operational programme	61
application of new technologies in production	50
application of new technologies in marketing	100
processing of products	44
establishing cooperation with other groups	44
	50

*Source: own study based on the directed interview with the management representatives.*

In accordance with the declarations of the managerial staff, the organisations in the near future will focus on disseminating, among their members, new fruit growing production methods aimed at improving the efficiency of the producer's holdings. In addition, the POs are planning to put a great emphasis on implementing the following functions: purchase of means of production at lower prices, processing of products, winning new outlet markets, establishing cooperation with other groups. A synthetic summary of the most important objectives of the POs for the future is presented in Table 8.

### **Conclusions**

1. In 2015, the producer groups and organisations in Poland accounted for almost 70% of entities bringing together the fruit growers, while about one-fourth of the horticultural groups marketed only fruit.
2. The spatial layout of the fruit grower groups and organisations was derived from the concentration of national fruit production, particularly with regard to production of tree fruit. The voivodeship leading in terms of the number of entities, members and cultivation areas concentrated in the POs was the Mazowieckie Voivodeship.
3. The fruit grower organisations were dominated by the producers of tree fruit. Half of them brought together only the producers of tree fruit, in turn, less than 10% of the entities brought together only the producers of berries. In case of about 40%, cooperation related to the producers of both fruit trees and berries.
4. The sales value achieved by the fruit growers who in 2014 were the producer organisation members amounted to about PLN 500 million and accounted for about 13% of the value of domestic commodity production of fruit. Products supplied by the members accounted for 70% of the sale of the POs, and the remaining 30% were products purchased from non-member producers. Referring the results of research carried out in 65 POs in 2014 to the entire community of the PGs and POs in 2015 (204), it can be estimated that those entities placed on the market about 35-38% of domestic fruit production.
5. The analysed entities were oriented towards production and sale of table fruit. Also, a high degree of product range specialisation has been recorded – the most important product category generated almost 90% of the sales value. Slightly more than half of production offered by the POs was sold without in-

termediaries (including direct sale to retail chains, processing plants and for export).

6. The number of the PO and PG member producers accounted for only 4% of holdings producing fruit and about 8% of holdings with the plantation area of more than 5 ha. Therefore, there is a great potential for the producers of fruit, especially the producers of berries, to become PO members.
7. In the near future, we should expect a slowdown in the process of horizontal integration in the fruit sector. Certainly, this will be the effect of the already achieved level of market organisation, however, other considerations will also be of importance. Firstly, co-financing for the investment activity of the entities will take place according to the definitely less attractive conditions and may not be a sufficient incentive to establish new entities. Secondly, the already functioning producer organisations tighten their requirements towards potential members, and some of them do not plan to expand their member community.
8. Nevertheless, the rules for granting investment aid to individual farmers under the RDP 2014-2020 may encourage plantation owners to form organisations due to the fact that under the new programme it will be relatively more difficult to receive grants for modernisation in individual agricultural holdings. These grants will, in fact, have to meet three objectives – innovation, environmental protection, climate protection. Not each investment – and, in particular, the purchase of basic equipment – will meet these criteria. This situation may be a reason for which forming organisations and acquiring co-financing from the operational fund within the framework of the organisation will become more attractive for the producers.
9. Most of the companies bringing together the fruit growers implemented the recognition plan within the framework of the EU common organisation of the market in fruit and vegetables and now have the producer organisation status. Thus, these entities are subject to different rules of support than the producer groups. In the recognition period, the groups focused on investing in fixed assets allowing to perform marketing functions related to the concentration of supply, physical distribution and preparing products for sale. Based on the research results, it may be concluded that, in the future, the PO will put a greater emphasis on optimising the production process by financing of investments at the producer level.

10. In the state activities for the better organisation of the market in fruit, it is worth noting the creation of incentives to the development of cooperation of the groups, *inter alia*, with regard to the joint sale, use of storage facilities, promotion. It is also worth encouraging the POs to more formalise cooperation with non-member suppliers of products (e.g. in a form of cooperation agreements or through the associate membership), which, to a greater extent, will protect both parties in terms of the compliance with the conditions accompanying the transaction.

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# GROSS MARGIN FROM SELECTED AGRICULTURAL PRODUCTS – REGIONAL APPROACH<sup>69</sup>

## Introduction

Poland is a country which is highly diversified regionally. Polish agriculture is also characterised by the great diversification. It is a result of a number of factors, *inter alia*, natural (i.e. soil and climate conditions, water resources and relief), demographic and organisational-economic<sup>70</sup>.

According to Heller<sup>71</sup>, the diversification of agriculture is an integral part of the regional diversification of rural areas. The most general definition of the regionalisation of agriculture is as follows: [...] *It is the spatial adaptation of agriculture, i.e. its internal structure (crop and animal production), intensiveness and productivity to the existing manufacturing potential (natural and socio-economic) in the region, so that the resulting scale and efficiency of the agricultural production guarantee the most expected income.* The presented definition of the regionalisation of agriculture is fully justified in relation to various economic systems. Different conditions, which are derived from the economic system may lead to various effects. In connection with the fact that the processes of regionalisation, i.e. spatial diversification of agriculture are long-term (multi-annual), their effects appear after a few years and even decades later. So, we may conclude that the today level of the regional diversification of agriculture, in addition to natural conditions, has been shaped – if we take as a basis only the second half of the 20<sup>th</sup> century – by three different economic systems. The first, which lasted for the longest time, was the command-and-quota system, it functioned within the centrally planned economy. The second, which was a short-lived episode, may be described as relatively free market conditions similar to the liberal economic system. This period was launched by the so-called market orientation of agriculture in mid-1989, and formally ended

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<sup>70</sup> W. Poczta, N. Bartkowiak, *Regionalne zróżnicowanie rolnictwa w Polsce*. J. Agribus. Rural Dev. 2012, 1(23), pp. 95-109.

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

<sup>71</sup> J. Heller, *Teoretyczne podstawy regionalizacji rolnictwa*, [in:] *Regionalne zróżnicowanie produkcji rolniczej w Polsce*. Program Wieloletni 2005-2010, No. 3, IUNiG-PIB, Puławy 2006, pp. 7-17.



on 1 May 2004, i.e. at the time of Poland's accession to the European Union. The third stage is related to the implementation of the common agricultural policy, as its beginning we may adopt, for example, the date of completing the accession negotiations in two areas: structural and regional policy and agriculture, i.e., in the third quarter of 2002.

When considering the conditions of the regionalisation of agriculture, we may not ignore the previous periods in which the current shape of the agrarian structure in Poland was developed. Similarly, just like the long-term processes shape the level of the regional agricultural development, the basis for the general regional development are multi-annual historical conditions<sup>72</sup>.

The agrarian structure reflects not only the diversification of the physical size of holdings, but also their production potential (i.e., resources of factors of production – land, labour and capital) and the resulting possibility of generating income. Changes in the agrarian structure of holdings are determined by changes in the production structure of crop and livestock products. The directions of production – in accordance with the “economies of scale” – are adjusted to owned land resources.

The objective of the research is to identify the main factors determining the regional diversification of the profitability of agricultural production activities, which were covered by the research in 2015. In conventional holdings, the evaluation covered the results of spring barley, maize for grain, edible potatoes and selected legumes, i.e. sweet lupin, fodder pea and soybean. In contrast, in organic holdings, the evaluation covered the milk production results. The study devoted much attention to direct costs of production, its level determines the intensiveness of conducted production, and at the same time largely depends on the farmer.

### **Material and research method**

The empirical data for agricultural production activities which were covered by the research in 2015 in conventional farms (spring barley, maize for grain, table potatoes, sweet lupin, fodder pea and soybean) and organic farms (dairy cows) were collected in individual agricultural farms located across Poland. The farms for the research were selected purposively from a representative sample of holdings, which was observed by the Polish FADN. The research on the activity was conducted according to the methodology

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<sup>72</sup> J. Heller, *Teoretyczne podstawy regionalizacji rolnictwa*, [in:] *Regionalne zróżnicowanie produkcji rolniczej w Polsce*. Program Wieloletni 2005-2010, no. 3, IUNiG-PIB, Puławy 2006, pp. 7-17.

established for the AGROKOSZTY system, in which the data on the level of production and on incurred inputs and direct costs are collected and processed<sup>73</sup>.

According to the literature, the amount of inputs of current assets per unit of production evidences the intensiveness in agriculture<sup>74</sup>. Adopting as a measure of intensiveness inputs for basic current assets<sup>75</sup> – which in the research are expressed in terms of value by the level of direct costs – the evaluation covered the diversification of intensiveness of production in the analysed activities in regional terms. Therefore, intensiveness is evidenced by the amount of inputs, regardless of whether or not they proved rational in their effects.

The results of the research were presented in a tabular and graphic form, a horizontal analysis was used by comparing the parameters characteristic of the analysed activities in the selected farms from 4 agricultural regions<sup>76</sup>. The results of the analysed activities were also presented as the sample average. The research covered revenues, i.e., the value of potentially commercial production from 1 ha of the cultivated area and per 1 dairy cow as well as inputs, costs and economic effects. As a basic indicator of the evaluation of achieved effects, the level of the gross margin without subsidies was adopted. This category means a difference between the production value and direct costs necessary for its generation.

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<sup>73</sup> Direct costs of crop production include: costs of seed material, purchased fertilisers, plant protection products and plant growth regulators, insurance of the activity concerned and specialist costs, i.e. concerning directly a given activity as well as improving the quality and value of the final product (e.g. cost of water for irrigation, soil analysis). In contrast, direct costs of animal production include: costs of animals entering the herd for replacement purposes, costs of fodder, rents for using fodder area for up to 1 year, treatment and insurance of animals and specialist costs (e.g. animal classification, costs of feed preservatives and feed storage); their role is the same as in the case of crop production – cf. Skarżyńska A., *Koszty jednostkowe i dochody wybranych produktów w 2013 roku – wyniki badań w systemie AGROKOSZTY*, Zagadnienia Ekonomiki Rolnej, no. 2, IERiGŻ-PIB, Warsaw 2015, pp. 112-132.

<sup>74</sup> Manteuffel R., *Ekonomika i organizacja gospodarstwa rolniczego*, PWRiL, Warsaw 1984, pp. 163-171.

<sup>75</sup> Current assets in agriculture are divided into primary and secondary assets. The former are part of newly manufactured products, e.g. seeds, fertilisers, young animals for fattening. The latter, however, are not part of that new product, but are necessary in the production process, e.g. electricity, fuel, lubricants, heating fuel, materials for ongoing renovations and maintenance of fixed assets – cf. *Encyklopedia ekonomiczno-rolnicza*, PWRiL, Warsaw 1984, p. 770.

<sup>76</sup> Agricultural regions cover the following voivodeships: 1) **Pomorze and Mazury** – Lubuskie, Zachodniopomorskie, Pomorskie, Warmińsko-Mazurskie; 2) **Wielkopolska and Śląsk** – Wielkopolskie, Kujawsko-Pomorskie, Dolnośląskie, Opolskie; 3) **Mazowsze and Podlasie** – Podlaskie, Mazowieckie, Łódzkie, Lubelskie; 4) **Małopolska and Pogórze** – Świętokrzyskie, Śląskie, Małopolskie, Podkarpackie.

The gross margin without subsidies enables the evaluation of the economic efficiency of manufacturing individual agricultural products depending on the fluctuations in crop yields, performance of animals, changes in prices of products and in prices of means of production. It also allows to properly evaluate the competitiveness of production as it covers the obtained production value and incurred, specific direct costs. The gross margin without subsidies may also be increased by certain types of direct payments (gross margin without subsidies + subsidies = gross margin).

The performed calculations and analyses included single area payment (SAP), payment for greening, additional payment, payment for high-protein crops and payment for cows. On the basis of the data on subsidies received for analysed agricultural products in the analysed holdings and the amount of direct payments in 2015 and the rules of their granting, we have calculated the maximum amount of subsidies, which farmers could receive provided that they met all requirements.

To evaluate the analysed production activities – regardless of the level of the gross margin – a group of indicators determining the economic efficiency of production has been used, i.e.:

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

Due to the electronic data processing technology, for some calculations differences may occur due to rounding up.

### **Regional diversification of the gross margin from selected agricultural products in 2015**

**Spring barley.** Barley is the primary species of cereals cultivated for fodder grain. In Poland, mainly the spring form is cultivated, which in 2015 in the structure of total barley sowings accounted for 72.5%, and in total cereals – 8.1%. Barley grain is used mainly for fodder purposes, but it also plays an

important role in the food industry for production of malt, it is also used for consumption purposes – to produce flakes, cereal germs or groats<sup>77</sup>.

According to the public statistical data, the cultivation area of spring barley in 2000-2015 was subject to strong fluctuations. In 2000 and 2005, the cultivation area of that cereal was similar. A strong decrease was recorded in 2010. The cultivation area of spring barley in Poland in 2010, compared to 2009 (929,864 ha) decreased by 22.1%, while in relation to 2005 it decreased by 25.2%. In 2011, there was a slight increase in the cultivation area of that cereal. However, in 2012, spring barley was cultivated on the record-breaking area – more than 1,008,000 ha. However, in 2013-2015 the area of sowings became relatively stable at the level of 588-608 thousand ha. From the CSO data it results that in the analysed period, the largest cultivation area of spring barley was characteristic of the Wielkopolska and Śląsk region. A relatively large cultivation area was also recorded in the Mazowsze and Podlasie region.

The barley yield is determined by: genetic potential of yielding of the variety, soil quality, climate and type of the applied cultivation technology. According to the data presented by the FAO, the world's highest barley yields are obtained in the United Arab Emirates, in 2015, they amounted to 78 dt/ha. The high yields are also recorded in Belgium (77 dt/ha), Ireland (68 dt/ha), France and the Netherlands (63 dt/ha)<sup>78</sup>. In Poland, yielding of this cereal is much lower. The spring barley yield level in individual holdings in 2000-2015 was in general quite similar. It oscillated around 30 dt/ha, the exception is the year 2000, when it was the lowest – about 25 dt/ha and 2014 when it was the highest – 37 dt/ha. It is also worth adding that the highest yield was recorded in the Wielkopolska and Śląsk region (2015 – 33.5 dt/ha), and the lowest in the Mazowsze and Podlasie region (2015 – 30.5 dt/ha).

In 2000-2003, the barley price in Poland was higher than in the European Union. However, after accession to the EU it was at a similar level as in the neighbouring Member States<sup>79</sup>. From 2005 to 2008, there was a significant rise in the grain price while in 2009 it dropped to about PLN 41 per dt. However, in the next three years the barley price was rising gradually, until in 2012 it reached the level of PLN 81.91 per dt, which has never been seen before. This high barley grain price resulted mainly from the relatively small stocks of

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<sup>77</sup> A. Najewski, *Zboże wysokiej jakości*, ed. 2, Agro Serwis, June 2005.

<sup>78</sup> FAOSTAT. *Food and agriculture organization of the united nations statistics division*, <http://faostat3.fao.org/browse/Q/QC/E> [access: 07.06.2016].

<sup>79</sup> Stańko S., *Zewnętrzne uwarunkowania rozwoju rolnictwa*, Roczniki Nauk Rolniczych, Series G, vol. 94, issue 2, Warsaw 2008.

cereals in the world, and thus from the limited availability of grain. In 2015, the barley grain price decreased, compared to 2012 by 25.8%.

According to the CSO data, in 2015, the barley grain buying-in price was, on average, PLN 61.04 per dt, but in the individual voivodeships its amount was diversified. The lowest price for 1 dt was obtained by farmers in the Podkarpackie Voivodeship (on average PLN 52.64), and the highest – in the Dolnośląskie Voivodeship (on average PLN 65.21).

In 2015, as part of the research conducted in the AGROKOSZTY system, the evaluation covered the profitability of cultivating spring barley. The research was conducted in 188 individual holdings. Its results were presented as the sample average and as the groups of holdings average in four agricultural regions of Poland, i.e. Pomorze and Mazury, Wielkopolska and Śląsk, Mazowsze and Podlasie, and Małopolska and Pogórze. The classification was to determine the level of the gross margin from the cultivation of barley and to identify the factors determining its amount.

In the analysed group of holdings cultivating spring barley, the average grain sales price amounted to PLN 59.72 per dt and was by 2.2% lower than the average buying-in price on a national scale (PLN 61.04 per dt). The barley grain yield also varied, on average, in the analysed group of holdings it was 44.5 dt/ha, while in individual holdings in the country – 32.0 dt/ha. When analysing the differences in the levels of prices and yields in the regions, we may see that in the Wielkopolska and Śląsk region, where grain was sold at the highest price (PLN 64.56 per dt), the price was by 21.3% higher than the lowest price obtained in the Małopolska and Pogórze region (PLN 53.22 per dt).

A similar difference could be observed between the extreme yield values. Its level in the Małopolska and Pogórze region was the highest (49.7 dt/ha), by 27.8% higher than the lowest level obtained in Pomorze and Mazury (38.9 dt/ha) – Table 1.

The level of production value from 1 ha of the cultivation of spring barley was determined by the production and price conditions. On average, in the analysed sample of holdings, the total production value amounted to PLN 2,675, while in the selected regions it ranged from PLN 2,333 to 3,065. The best result in this respect was recorded in the Wielkopolska and Śląsk region, and the worst – in Pomorze and Mazury – Table 1.

Table 1. Production, costs and gross margin achieved in 2015 from the cultivation of spring barley, as the research sample average and as the selected holdings average in the agricultural regions of Poland (actual data)

Specification	Average in holdings cultivating spring barley	Average in selected holdings in region			
		Pomorze and Mazury	Wielkopolska and Śląsk	Mazowsze and Podlasie	Małopolska and Pogórze
Number of surveyed farms	188	48	48	43	49
Utilised agricultural area [ha]	55.83	68.92	62.20	38.69	51.81
Growing area [ha]	8.61	10.44	9.97	6.39	7.43
Yield of grain [dt/ha]	44.5	38.9	47.4	42.7	49.7
Selling price of barley [PLN/dt]	59.72	58.6	64.56	57.86	53.22
<b>Per 1 ha of growing area</b>					
Total value of production [PLN]	2675	2333	3065	2476	2643
Total direct costs [PLN]	894	791	954	826	1008
from this: sowing materials	168	157	189	166	156
fertilisers	521	474	538	477	596
organic fertilisers	5	7	-	16	-
plant protection products	176	138	194	146	227
growing regulators	19	11	30	16	21
other	4	3	3	4	8
Gross margin without subsidies [PLN]	1782	1542	2111	1651	1635
Total subsidies [PLN]	839	832	828	869	840
from this: single area payment	454	454	454	454	454
payment for greening	304	304	304	304	304
additional payment	81	74	70	111	82
Gross margin [PLN]	2621	2374	2939	2520	2476
Total labour input [hours]	7.5	6.9	7.0	8.3	8.3
in this: own labour input	7.2	6.7	6.3	8.3	8.3
<b>Indicators of economic efficiency</b>					
Share of direct costs in gross margin without subsidies [%]	50.2	51.3	45.2	50.0	61.6
Direct profitability indicator [%]	299.3	295.0	321.4	300.0	262.3
Direct costs / 1 dt [PLN]	20.09	20.33	20.11	19.35	20.29
Gross margin without subsidies / 1 dt [PLN]	40.05	39.63	44.52	38.69	32.93
Gross margin without subsidies / 1h of total labour input [PLN]	238.01	224.10	302.09	197.78	196.63
Share of subsidies in gross margin [%]	32.0	35.0	28.2	34.5	33.9

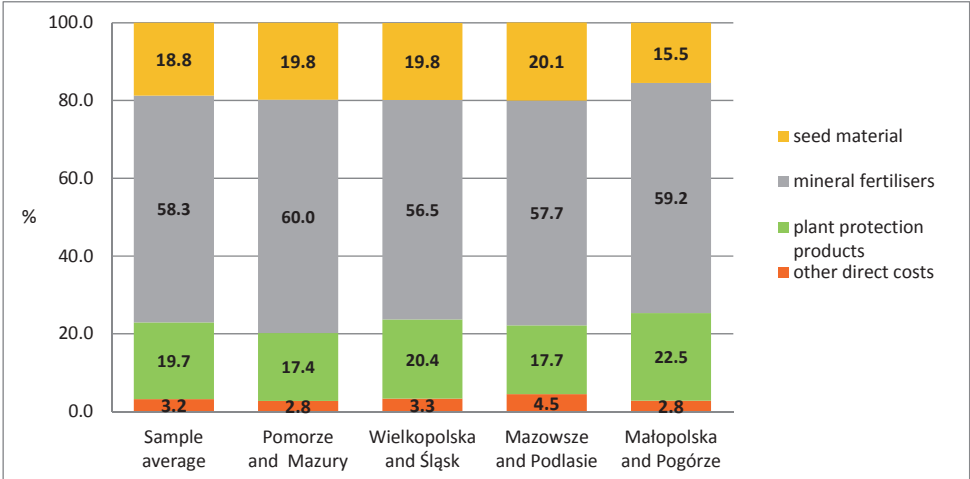
[-] means that a specific phenomenon did not occur

Source: own study based on the data from the AGROKOSZTY system.

On average, in the analysed group of holdings, direct costs per 1 ha of spring barley amounted to PLN 894. The highest costs were incurred by barley grain producers in the Małopolska and Pogórze region, while the lowest by those in Pomorze and Mazury. When comparing the extreme values in the regions, the difference in the level of direct costs was – PLN 217. In their structure, the greatest share was that of the cost of mineral fertilisers, it ranged

from 56.5% in the Wielkopolska and Śląsk region to 60.0% in Pomorze and Mazury. The other component with a large share was the cost of plant protection products which ranged from 17.4% in Pomorze and Mazury to 22.5% in the Małopolska and Pogórze region – Figure 1.

Figure 1. Structure of direct costs of the cultivation of spring barley in 2015, as the research sample average and as the selected holdings average in the agricultural regions of Poland (per 1 ha of the cultivation area)



Source: study based on own research.

In 2015, the cultivation of spring barley was favourable and allowed to obtain the gross margin without subsidies. On average, in the analysed holdings it amounted to PLN 1,782 per ha, while in regional terms it ranged from PLN 1,542 per ha in the Pomorze and Mazury regions to PLN 2,111 per ha in the Wielkopolska and Śląsk region. A significant impact on improving farmers’ income was exerted by subsidies, their total amount calculated per 1 ha, on average in the group was PLN 839. The share of subsidies in the gross margin (with subsidies) in the individual regions ranged from 28.2% to 35.0%. It should be noted that in Pomorze and Mazury, and in Mazowsze and Podlasie, the amount of subsidies exceeded the amount of direct costs incurred for the cultivation of barley.

As an indicator to evaluate the efficiency of the cultivation of spring barley in holdings differing in terms of their situation in the country, the direct profitability indicator has been adopted – expressed as a ratio of the production value to direct costs. On average, in the analysed holdings, that indicator was 299.3%. Its amount did not differ significantly among the regions. The highest was recorded in the Wielkopolska and Śląsk region (321.4%) and the lowest in



the Małopolska and Pogórze region (262.3%). When analysing other indicators describing the efficiency of using inputs incurred for the cultivation of barley and characteristic of the labour productivity, it was concluded that their most favourable amounts were in the holdings located in the Wielkopolska and Śląsk region. Farmers in that region obtained the highest gross margin without subsidies per 1 dt of grain (PLN 44.52), and in addition, the share of direct costs in the gross margin was the lowest (45.2%). Also, the highest gross margin without subsidies per 1 hour of total labour inputs was recorded there (PLN 302.09).

From the analysis carried out it results that the differences among the regions – as regards the amount of the gross margin obtained from the cultivation of spring barley – resulted from the relationship between the production value, resulting from the obtained yield and the grain sales price, and direct costs incurred. The highest gross margin without subsidies was obtained by producers from Wielkopolska and Śląsk (PLN 2,111). In terms of the economic efficiency, farmers from that region also achieved the best result, as evidenced by the direct profitability indicator – 321.4%. The cultivation of barley in the Wielkopolska and Śląsk region was also characterised by high cost competitiveness. The share of direct costs in the gross margin without subsidies was the lowest – it amounted to 45.2%, while in the Małopolska and Pogórze region it was the highest – 64.6%. In terms of the labour productivity, the holdings from the Wielkopolska and Śląsk region also achieved the best results. Both the technical and economic efficiency in that region was higher than in the groups of holdings from other agricultural regions.

**Maize for grain.** Maize is a plant with the high yielding potential. In addition, it is characterised by its universal application – for fodder and consumption purposes and as industrial and energy raw material. In Poland, in the past several years, the interest in the cultivation of this cereal has significantly increased. By the 1990s, it was cultivated mainly for green forage but recently the cultivation area of maize for grain has been increasing regularly. In 2000, the cultivation area of maize in Poland was at the level of 315 thousand ha, of which 48.0% (152 thousand ha) were intended for grain. In contrast, in 2015, the cultivation area of that cereal was 1,225 thousand ha, of which 670 thousand ha, i.e. 54.7%, were sown for grain<sup>80</sup>.

The distribution of maize cultivation in Poland, due to natural conditions, is very diversified. It is a thermophilic plant and its cultivation requires regionalisation. The selection of the right variety is a basic determinant of success. The surveys of the Central Statistical Office (CSO) show that between

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<sup>80</sup> *Użytkowanie gruntów i powierzchnia zasiewów w 2015 r.*, GUS, Warsaw 2016.



the years 2000 and 2005, as well as in 2010-2015 the Wielkopolska and Śląsk region was ranked first in terms of the cultivation area of maize for grain. The subsequent places were occupied by the regions: Mazowsze and Podlasie, Pomorze and Mazury, and Małopolska and Pogórze.

The maize yield level is determined by many factors, *inter alia*, soil quality, inputs of means of production (e.g. fertiliser consumption), cultivation of good quality varieties as well as weather conditions. The CSO data from several years back confirm the considerable diversification of yielding over the years resulting mainly from adverse weather conditions. The record-breaking maize grain yield was achieved by farmers in 2012 (on average, in individual holdings it was 70.5 dt/ha). This resulted mainly from favourable weather conditions. In contrast, in 2015, the yield was very low (46.3 dt/ha, i.e. by 34.3% lower than in 2012), it was a consequence of the country-wide drought in the growing season. However, it is worth noting that maize yielding varies regionally. Relatively, the highest yields are in the Wielkopolska and Śląsk region, and in Małopolska and Pogórze.

In 2000-2015, the level of annual average maize grain buying-in prices changed in various directions. The cereals balance, unfavourable since 2010 due to the low harvest, translated into a systematic rise in prices. In 2012, the price for 1 dt of maize reached a record-breaking level of PLN 72.85. On the other hand, since the beginning of 2013, the prices have dropped and this situation lasted until 2014. According to the CSO data, in 2015 the average maize grain buying-in price amounted to PLN 56.58 per dt, i.e. it was by 4.5% higher than in 2014 (PLN 54.13 per dt).

In 2015, the research in the AGROKOSZTY system covered the cultivation of maize for dry grain. The study attempted to evaluate the results obtained. The analysis covered the level of production, incurred inputs and costs and income in the form of the gross margin per 1 ha of the cultivation area. The database for the research were the source data collected in 79 individual agricultural holdings cultivating maize for grain. In order to demonstrate the differences and determinants of the amount of the gross margin from the cultivation of maize, the research results were presented as the research sample average and in regional terms.

Adverse weather conditions in 2015 had a negative impact on the maize yield level. According to the public statistical data, the average grain yield in individual holdings amounted to 46.3 dt/ha, while in the research sample of holdings it was higher by 36.5% and remained at the level of 63.2 dt/ha. However, it should be noted that the CSO provides the data on the yield of “semi-dry” maize grain, i.e. that with the water content of 15.1% to 16.0%,

while in the conducted research, as declared by farmers, the provided yield applies to dry grain, i.e. with the water content of less than 15%<sup>81</sup>. For this reason, comparing the yield is indicative. In 2015, the average maize buying-in price in the country was PLN 56.58 per dt. In contrast, on average, in the analysed holdings the price was by 7.3% higher and amounted to PLN 60.69 per dt.

When considering the production results of maize by regions, the significant diversification has been found – the grain yield per 1 ha ranged from 58.6 dt in the Wielkopolska and Śląsk region to 69.6 dt in the Małopolska and Pogórze region. However, regardless of the region the holdings involved in the research obtained the yield much higher than on average in individual holdings in the country. Also in case of the grain sales prices, the differences among the regions were observed. The highest price was obtained by farmers in Pomorze and Mazury – PLN 65.50 per dt, and the lowest – in the Małopolska and Pogórze region, PLN 56.59 per dt (Table 2).

The production and price conditions of maize in the individual regions determined the level of production value per 1 ha of the cultivation area. The best situation in this respect applied to farmers cultivating maize in the Mazowsze and Podlasie region, in those holdings the production value per 1 ha amounted to PLN 4,084. In contrast, its lowest level was recorded in the Wielkopolska and Śląsk region – PLN 3,521, i.e. by 13.8% less than in the Mazowsze and Podlasie region.

When analysing the level of the gross margin without subsidies, apart from revenues we should also consider direct costs incurred. The highest costs were incurred in the Małopolska and Pogórze region (PLN 2,212 per ha) and in Mazowsze and Podlasie (PLN 2,182 per ha), while the lowest – in Pomorze and Mazury (PLN 1,432 per ha). In the structure of direct costs of the cultivation of maize, the largest share was that of the cost of mineral fertilisers (38.2-51.0%), the second was the cost of seed material (25.7-29.9%). Of great importance were also other direct costs, whose amount was determined by the costs associated with additional drying of grain. Their share in total direct costs ranged from 11.2% to 20.5% – Figure 2.

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<sup>81</sup> Ryniecki A., *Dwuetaapowe suszenie kukurydzy*, Agro Serwis, ed. 3, January 2005, [http://www.ihar.edu.pl/suszenie\\_i\\_przechowywanie.php](http://www.ihar.edu.pl/suszenie_i_przechowywanie.php) [access: 05.09.2016].

Table 2. Production, costs and gross margin achieved in 2015 from the cultivation of maize for grain, as the research sample average and as the selected holdings in the agricultural regions of Poland (actual data)

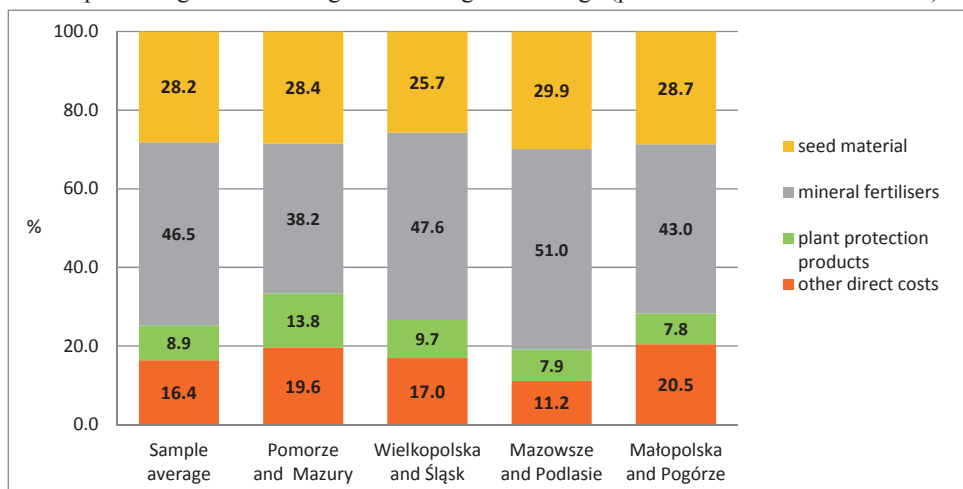
Specification	Average in holdings cultivating maize for grain	Average in selected farms in region			
		Pomorze and Mazury	Wielkopolska and Śląsk	Mazowsze and Podlasie	Małopolska and Pogórze
Number of surveyed farms	79	11	21	21	26
Utilised agricultural area [ha]	80.38	81.14	100.34	68.86	73.26
Growing area [ha]	21.08	17.48	24.63	23.31	17.94
Yield of grain [dt/ha]	63.2	59.4	58.6	63.2	69.6
Selling price of maize [PLN/dt]	60.69	65.5	60.07	64.58	56.59
<b>Per 1 ha of growing area</b>					
Total value of production [PLN]	3833	3893	3521	4084	3940
Total direct costs [PLN]	2028	1432	1939	2182	2212
from this: sowing materials	572	407	499	653	635
fertilisers	943	547	923	1113	951
organic fertilisers	14	43	9	0	24
plant protection products	180	198	187	172	174
growing regulators	0	0	0	1	0
other	318	237	321	243	429
Gross margin without subsidies [PLN]	1804	2461	1582	1902	1728
Total subsidies [PLN]	815	807	802	824	825
form this: single area payment	454	454	454	454	454
payment for greening	304	304	304	304	304
additional payment	57	49	44	66	67
Gross margin [PLN]	2620	3268	2384	2727	2552
Total labour input [hours]	9.3	7.3	9.9	7.6	11.2
in this: own labor input	8.3	7.3	7.2	7.5	10.7
<b>Indicators of economic efficiency</b>					
Share of direct costs in gross margin without subsidies [%]	1.12	0.58	1.23	1.15	1.28
Direct profitability indicator [%]	188.9	271.8	181.6	187.2	178.1
Direct costs / 1 dt [PLN]	32.12	24.10	33.08	34.5	31.78
Gross margin without subsidies / 1 dt [PLN]	28.57	41.41	26.99	30.08	24.82
Gross margin without subsidies / 1 h of total labour input [PLN]	194.47	337.22	159.91	250.5	154.58
Share of subsidies in gross margin [%]	31.1	24.7	33.6	30.2	32.3

[-] means that a specific phenomenon did not occur

Source: own study based on the data from the AGROKOSZTY system.

The research indicates that regional location of the holdings diversified the amount of direct costs to a greater extent than the level of revenues from the cultivation of maize, although the difference was not high. When comparing the extreme values, in the first case the difference per 1 ha was PLN 780, and in the second – PLN 563. It is worth noting that the largest differences occur in the cost of mineral fertilisers. This cost in the Mazowsze and Podlasie region was two times higher than that recorded in Pomorze and Mazury, where it was the lowest.

Figure 2. Structure of direct costs of the cultivation of maize for grain in 2015, as the research sample average and as the agricultural regions average (per 1 ha of the cultivation area)



Source: study based on own research.

In 2015, the economic results of the cultivation of maize at the level of the gross margin were favourable. Its level without subsidies, on average, in the research sample was PLN 1,804 per ha, while in regional terms it ranged from PLN 1,582 per ha in the Wielkopolska and Śląsk region to PLN 2,461 per ha in Pomorze and Mazury. Additional support for farmers cultivating maize for grain were subsidies, the calculation included single area payment, payment for greening and additional payment. An analysis carried out has shown that support in a form of subsidies improves income from the cultivation of maize. This is evidenced by its share in the gross margin with subsidies, which was from 24.7% in Pomorze and Mazury to 33.6% in the Wielkopolska and Śląsk region.

The production value, incurred costs and obtained economic results are closely interrelated. As an indicator to evaluate the efficiency of the cultivation of maize in the holdings differing in terms of their situation in the country, the direct profitability indicator was adopted which, on average, in the analysed group of holdings amounted to 188.9%. Taking into account the regional division of the holdings, the highest indicator was in Pomorze and Mazury (271.8%) and the lowest in the holdings from the Małopolska and Pogórze region (178.1%).

The most favourable values of the indicator describing the efficiency of using incurred inputs and characteristic of the labour productivity were recorded in the holdings in Pomorze and Mazury. Farmers in that region incurred, *inter alia*, the lowest direct costs per 1 dt of grain which amounted to PLN 24.10 and were by 30.1% lower as compared to the highest costs (PLN 34.50) incurred in

the holdings in Mazowsze and Podlasie. In addition, the highest gross margin without subsidies per 1 dt of grain (PLN 41.41) and per 1 hour of total labour inputs (PLN 337.22) was recorded in the Pomorze and Mazury region. The least favourable results from the cultivation of maize for grain were achieved in the holdings in the Małopolska and Pogórze region, and in Wielkopolska and Śląsk. This is evidenced by the indicators describing the profitability of production (respectively, PLN 24.82 and PLN 26.99 per dt) and the profitability of labour inputs (respectively PLN 154.58 and PLN 159.91 per hour).

Summing up, it must be concluded that the differences among the regions as regards the level of the gross margin from the cultivation of maize resulted from several factors. The main determinant was the level of revenues determined by the amount of yield and grain sales price, but direct costs also had their impact. The highest gross margin without subsidies was obtained by maize producers in the Pomorze and Mazury region (PLN 2,461 per ha). In that region, the cost of producing 1 dt of grain was the lowest (PLN 24.10), and the profitability of production (PLN 41.41 per dt), labour inputs (PLN 337.22 per hour) and economic efficiency of production (271.8%) were the highest. The second place, given the favourableness of those indicators, was occupied by the Mazowsze and Podlasie region. In contrast, the weakest results were recorded in two other regions, i.e. Małopolska and Pogórze and Wielkopolska and Śląsk.

The advantage of the cultivation of maize in Pomorze and Mazury is also evidenced by its cost competitiveness – direct costs in the gross margin without subsidies accounted for 58%, while in the other regions they significantly exceeded its level. The results indicate that the role of subsidies in the regions was different. Maize producers in Pomorze and Mazury received support in the amount of PLN 0.33 to PLN 1 of the gross margin obtained from production, while in the regions that support was as follows: in Mazowsze and Podlasie – PLN 0.43, in Małopolska and Pogórze – PLN 0.48 and in Wielkopolska and Śląsk – PLN 0.51.

**Edible potatoes.** Potatoes are one of the most important crops in Poland and in the world. Relatively small soil and climatic requirements and universal application, both for consumer and industrial purposes (e.g. in food processing, spirits and starch industries) are a reason for which potatoes are cultivated almost all over the world. Despite the decreasing scale of the cultivation of this species, it is still very popular in Europe and in Poland<sup>82</sup>.

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<sup>82</sup> Jankowska J., *Sytuacja rynkowa ziemniaka w Europie przedstawiona na spotkaniu komitetu COPA-COGECA w Brukseli*, Ziemiak Polski, No. 2, 2012.

Potatoes (in total) in Poland in 2005 were cultivated in about 1.4 million of holdings, and in 2012, only in 600 thousand. Although over 35 years the cultivation area of potatoes has been very reduced (by about 80%), they still belong to few plants commonly cultivated across the country. Due to the universality of their cultivation, production is conducted by holdings with the very diversified potential, scale of cultivation and level of commerciality of production and using technologies with various levels of modernity<sup>83</sup>.

From the CSO data it results that the cultivation area of potatoes (in total) in Poland was significantly reduced. In 2000, it was 1,250,600 ha, while in 2015 only 300,355 ha. This means a 4-fold decrease over 15 years. Throughout the 15-year period, the largest cultivation area of potatoes was in the Mazowsze and Podlasie region, the smallest – in Pomorze and Mazury. In 2015, it was 107,744 and 44 299 ha, respectively. In the remaining two agricultural regions of Poland, i.e. Wielkopolska and Śląsk, and Małopolska and Pogórze, the cultivation area of potatoes was very similar, in 2015 it was 77,227 and 71,085 ha, respectively.

The public statistical data from the years between 2000 and 2015 show a significant diversification in the yielding of potatoes (in total) in Poland. The highest average yield in the individual holdings was obtained in 2014 (272 dt/ha). It was by 56.3% higher than the lowest yield obtained in 2005 (174 dt/ha). The highest yields in almost all years were obtained in the Wielkopolska and Śląsk region. An exception were the years 2014-2015. The difference in favour of the highest yield obtained in the Pomorze and Mazury region in 2014 was small – 0.7%, but it definitely increased in 2015 – to 14.2%. Owing to the changes which occurred from 2000 to 2015 in the total cultivation area and yielding of potatoes, we may most likely assume that the similar changes occurred also in case of the cultivation of table potatoes.

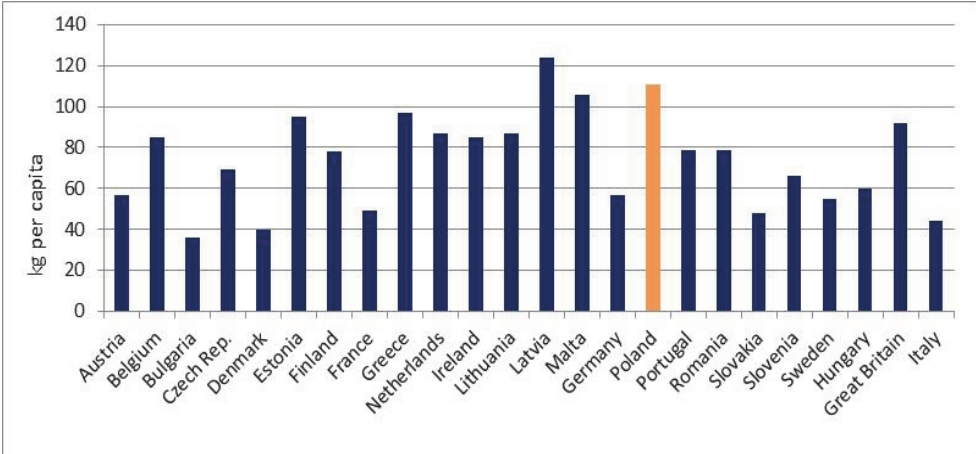
The average annual table potato buying-in price in Poland rose until 2011, with minor fluctuations. Only in the recent years, have the greater fluctuations been observed. According to the CSO, in 2013 when compared to 2012, the average price in Poland rose by as much as 43.3%, and in 2014 it decreased by 19.3%. In 2015, the average table potato buying-in price amounted to PLN 51.15 per dt and was by 1.6% lower than in 2014. In 2015, the highest buying-in price was recorded in the Warmińsko-Mazurskie Voivodeship – PLN 65.24 per dt, it was by 27.6% higher than the average price in the country. In contrast, the lowest price was recorded in the Podlaskie Voivodeship – PLN 33.61 per dt, by 34.3% lower than the average price in the country.

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<sup>83</sup> Józwiak W., *Polskie rolnictwo i gospodarstwa rolne w pierwszej i drugiej dekadzie XXI wieku*, Program Wieloletni 2011-2014, No. 53, IERiGŻ-PIB, Warsaw 2012.

Currently, potatoes are used mainly for consumption purposes. In Poland, when compared to other EU countries, the consumption of potatoes is very high. In 2011, the consumption of raw and processed potatoes in potato equivalent amounted to 111 kg *per capita*. Larger consumption was recorded only in Latvia – 124 kg. Slightly smaller than the consumption in Poland was that in Malta and Greece, 106 and 97 kg *per capita*, respectively. In the same year, the consumption in Hungary amounted to 60 kg, and in Germany 57 kg. The lowest consumption is in Denmark – 40 kg and Bulgaria – 36 kg<sup>84</sup> (Figure 3).

Figure 3. Annual consumption of potatoes\* in the selected European Union countries in 2011



\*Raw and processed potatoes in potato equivalent.

Source: Rynek ziemianka. Stan i perspektywy, No. 41, IERiGŻ-PIB, ARR, MRiRW, Warsaw 2014.

In 2015, the results of the cultivation of table potatoes were subject to research in the AGROKOSZTY system. The data on the level of production, incurred inputs and direct costs were collected in 138 individual holdings situated throughout the country. The results of that research were presented as the entire group average and as the average for groups of holdings selected by situation in the agricultural regions – Table 3.

<sup>84</sup> Rynek ziemianka. Stan i perspektywy, No. 41, IERiGŻ-PIB, ARR, MRiRW, Warsaw 2014.

Table 3. Production, costs and gross margin achieved in 2015 from the cultivation of potatoes, as the research sample average and as the selected holdings average in the agricultural regions of Poland (actual data)

Specification	Average in holdings cultivating edible potatoes	Average in selected farms in region			
		Pomorze and Mazury	Wielkopolska and Śląsk	Mazowsze and Podlasie	Małopolska and Pogórze
Number of surveyed farms	138	39	42	27	30
Utilised agricultural area [ha]	45.48	61.1	38.41	33.82	45.58
Growing area [ha]	4.73	3.41	3.94	7.35	5.21
Yield of potatoes <sup>a</sup> [dt/ha]	248.0	233.0	251.0	246.0	259.0
Selling price of potatoes [PLN/dt]	56.89	55.59	57.78	63.82	50.73
<b>Per 1 ha of growing area</b>					
Total value of production [PLN]	14098	12976	14511	15689	13140
Total direct costs [PLN]	3237	2919	3431	2761	3905
from this: sowing materials	1554	1489	1789	1213	1795
fertilisers	979	753	882	1006	1238
organic fertilisers	23	82	0	0	27
plant protection products	520	439	591	373	701
growing regulators	11	10	20	9	3
other	150	145	150	160	140
Gross margin without subsidies [PLN]	10861	10057	11080	12928	9235
Total subsidies [PLN]	861	842	862	870	864
form this: single area payment	454	454	454	454	454
payment for greening	304	304	304	304	304
additional payment	103	84	104	112	106
Gross margin [PLN]	11722	10898	11942	13798	10100
Total labour input [hours]	81.6	84.1	66.0	86.9	89.3
in this: own labour input	66.9	60.3	55.2	68.9	82.5
<b>Indicators of economic efficiency</b>					
Share of direct costs in gross margin without subsidies [%]	29.8	29.0	31.0	21.4	42.3
Direct profitability indicator [%]	435.6	444.5	422.9	568.2	336.5
Direct costs / 1 dt [PLN]	13.05	12.53	13.67	11.22	15.08
Gross margin without subsidies / 1 dt [PLN]	43.8	43.16	44.14	52.55	35.66
Gross margin without subsidies / 1h of total labour input [PLN]	133.11	119.58	167.88	148.77	103.42
Share of subsidies in gross margin [%]	7.3	7.7	7.2	6.3	8.6

<sup>a</sup> minus storage losses

[-] – means that a specific phenomenon did not occur

Source: own study based on the data from the AGROKOSZTY system.

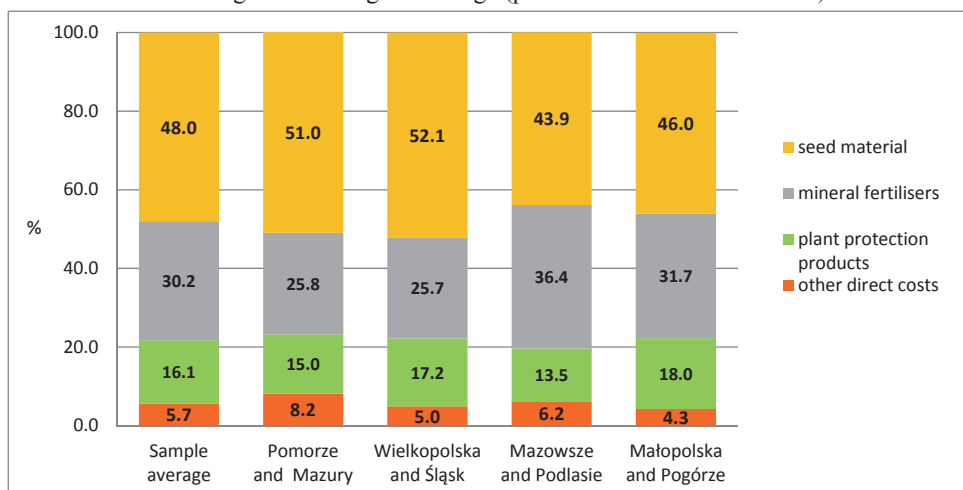
The amount of the gross margin is determined by the production value and direct costs. The production value depends on the sales price and the yield. On average, in the analysed holdings, the potato yield was at the level of 248 dt/ha, that result was by 21.6% higher than the average for individual holdings



in the country (204 dt/ha). The sales price (PLN 56.89 per dt) was also higher (by 11.2%) than the national average buying-in price recorded by the CSO (PLN 51.15 per dt)<sup>85</sup>. The highest potato yield in the analysed holdings was recorded in the Małopolska and Pogórze region, it amounted to 259 dt/ha and was by 4.4% higher than the average in the analysed group of holdings. The higher than the average yield (by 1.2%) was also recorded in the Wielkopolska and Śląsk region (251 dt/ha). The lowest potato yield per 1 ha was obtained by farmers from Pomorze and Mazury (233 dt).

The average table potato sales price achieved by farmers in the majority of the agricultural regions was higher than the buying-in price provided by the CSO. Only in the Małopolska and Pogórze region, producers achieved the price lower than the national average (by 0.8%). The best price situation took place in the holdings from Mazowsze and Podlasie, where 1 dt of table potatoes cost, on average, PLN 63.82, i.e. by 24.8% more than provided by the public statistical data. This price diversification may be related to a form (purchase – marketplace) and time of sales. According to the CSO data<sup>86</sup>, in 2015, the table potato price in marketplaces amounted to PLN 82.04 per dt, i.e. it was by as much as 60.4% higher than the buying-in price.

Figure 4. Structure of direct costs of the potato cultivation in 2015, as the group average and as the agricultural region average (per 1 ha of the cultivated area)



Source: study based on own research.

<sup>85</sup> Wyniki produkcji roślinnej w 2015 r., GUS, Warsaw 2016; Skup i ceny produktów rolnych w 2015 r., GUS, Warsaw 2016.

<sup>86</sup> Ceny w gospodarce narodowej w 2015 r., GUS, Warsaw 2016.

The research results indicate the regional diversification of both the level and structure of direct costs incurred for the cultivation of potatoes. In the structure of direct costs, the dominant share was that of the cost of seedling material, it accounted for from 43.9% to 52.1%. Noteworthy, however, is the fact that in the regions: Wielkopolska and Śląsk, and Małopolska and Pogórze purchased seedlings accounted for more than 50.0% of that cost. As a result, those regions recorded the highest cost of seedlings amounting to PLN 1,789 and 1,795 per ha, respectively. Cost of mineral fertilisers also had a large share in direct costs (from 25.7% to 36.4%) which, depending on the region, ranged from PLN 753 per ha in Pomorze and Mazury to PLN 1,238 per ha in the Małopolska and Pogórze region – Figure 4.

The research conducted showed that in 2015, the economic results of the cultivation of potatoes at the level of the gross margin without subsidies were very favourable. On average, in the research sample, farmers achieved PLN 10,861 per ha. Having regard to the regional breakdown, the best results in that respect were achieved by the holdings from Mazowsze and Podlasie (PLN 12,928 per ha). The further positions were occupied by the Wielkopolska and Śląsk region (PLN 11,080 per ha), and Pomorze and Mazury (PLN 10,057 per ha). The lowest gross margin was obtained by farmers from Małopolska and Pogórze (PLN 9,235 per ha). The difference between the extreme values of the gross margin resulted from the diversified potato sales price. In the Mazowsze and Podlasie region – when compared to Małopolska and Pogórze – the sales price was higher by 25.8%.

Taking into account subsidies for the cultivation of potatoes, it may be concluded that they had little impact on improving the income situation. On average, in the analysed group of holdings, the share of subsidies in the gross margin was 7.3%, and in the selected regions it ranged from 6.3% to 8.6%.

In order to examine the differences and evaluate the economic efficiency of the cultivation of table potatoes in the holdings differing in terms of their situation in the country, the direct profitability ratio was adopted – expressed as a ratio of the production value to direct costs in percentage terms. On average, in the analysed holdings, that indicator amounted to 435.6%. Taking into account the regional breakdown, the amount of that indicator was the highest in the Mazowsze and Podlasie region (568.2%) and the lowest in the holdings from Małopolska and Pogórze (336.5%), which coincides with the classification of those regions in terms of the gross margin.

The efficiency of the cultivation of table potatoes in Mazowsze and Podlasie – against a background of the remaining regions – was relatively high. This is evidenced by the smallest share of costs in the gross margin without

subsidies (21.4%) and the highest profitability of production (PLN 52.55 per dt). The calculations show also the low efficiency of potato production in the Małopolska and Pogórze region. Direct costs in that region accounted for 42.3% of the generated gross margin. Against a background of the remaining regions, the value of that indicator was the least favourable, which evidences the relatively low cost competitiveness. The lowest was also the gross margin per 1 dt of potatoes – PLN 35.66 and per 1 hour of total labour inputs – PLN 103.42.

Summing up, it must be concluded that the cultivation of table potatoes in 2015 was very profitable. The highest gross margin was obtained in Mazowsze and Podlasie – PLN 12,928, and the lowest in the Małopolska and Pogórze region – PLN 9,235. Despite the high profitability, no growing interest in the cultivation of table potatoes is observed. This is related to the regularly decreasing consumption and making up for any potential shortages with imported potatoes. In addition, when compared to other species of crops, potatoes are characterised by high cultivation costs. The holdings cultivating potatoes on a small scale often have a problem to sell their crops. This is connected with the development of retail chains cooperating with large specialised holdings and packing centres<sup>87</sup>.

The amount of the gross margin from the cultivation of table potatoes was dependent mainly on the level of revenues. Only in the Małopolska and Pogórze region, the factor which negatively affected and had a significant impact on its amount were direct costs. In that region, both the level and share of costs in the generated gross margin was the largest. Consequently, the region moved down from the third to the fourth position in terms of revenues, due to the amount of the gross margin without subsidies.

**Cultivation of legumes in Poland – selected issues.** Climatic conditions in Poland enable the cultivation of legumes in the country. These crops are important for conventional and organic farming, are a part of the European Union programme regarding the so-called greening and related direct payments. Greening means compulsory climate- and environment-friendly agricultural practices. One of the greening requirements is to maintain the ecological focus areas on arable land and legumes may participate in this part.

The interest in legumes results mainly from the multiple possibilities of using them. They are cultivated for seeds used for industrial (oil production), consumption and fodder purposes, and for raw materials to produce feed concentrates, green forage, green manure and management of set-aside land. The protein content in legume seeds is the highest among all the crop species

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<sup>87</sup> *Rynek ziemianka. Stan i perspektywy*, No. 42, IERiGŻ-PIB, ARR, MRiRW, Warsaw 2015.

and varies from 20% (pea) to 45% (yellow lupin), and some species also contain a lot of fat (soybean, white lupin). Protein of these crops is characterised by a significant proportion of essential amino acids, mainly lysine<sup>88</sup>.

Food security in terms of vegetable protein is the overarching objective of the economic policy of each country, therefore, it requires the provision of diverse and reliable sources of this protein. Historically, in the Polish conditions, the needs in terms of fodder vegetable protein were satisfied using native species of legumes (pea, lupin). The development of global trade, however, triggered the process of replacing protein of native legumes, in fodder for poultry and pigs, with imported soybean protein which was easily accessible and competitive in terms of price and quality. For this reason, in 1990 there was a collapse of national production of legume seeds, while creating favourable conditions to increase the import of soybean meal. As a consequence, this process has led to a situation where the current national demand for vegetable protein in more than 80% is covered by imported soybean protein. This process involves the phenomenon of the dependence of both Poland and many other EU countries on foreign sources of vegetable protein, causing a risk to state security in terms of the supply of vegetable protein, in particular for fodder purposes. Therefore, a problem of restitution of production and the market of native legumes has become valid<sup>89</sup>.

Poland has a deficit of vegetable protein needed for production of fodder for poultry, pigs and other animals, amounting to about 850 thousand tonnes (77%). To meet these needs, it is necessary to import about 2.5 million tonnes of post-extraction soybean meal, the price of which in the world markets is steadily rising and probably will rise. In the recent years, more than PLN 4 billion have been spent annually on import of post-extraction soybean meal. This situation is a reason for which Poland does not have “protein security” and, increasingly, animal production is dependent on the import of the major protein raw material, i.e. post-extraction soybean meal<sup>90</sup>. According to Rutkowski<sup>91</sup>, Poland does not

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<sup>88</sup> Księżak, *Wstęp*, [in:] *Wybrane zagadnienia uprawy roślin strączkowych* (ed. prof. dr hab. J. Księżak). Fundacja Programów Pomocy dla Rolnictwa FAPA, Warsaw 2015, p. 5.

<sup>89</sup> M.A. Jerzak, *Uwarunkowania rozwoju produkcji i rynku rodzimych roślin strączkowych na cele paszowe w Polsce*, [in:] *Wybrane zagadnienia uprawy roślin strączkowych* (ed. prof. dr hab. J. Księżak). Fundacja Programów Pomocy dla Rolnictwa FAPA, Warsaw 2015, p. 44

<sup>90</sup> J. Księżak, J. Szukała, *Ważniejsze elementy agrotechniki roślin strączkowych*, [in:] *Wybrane zagadnienia uprawy roślin strączkowych* (ed. prof. dr hab. J. Księżak). Fundacja Programów Pomocy dla Rolnictwa FAPA, Warsaw 2015, p. 17.

<sup>91</sup> J. Florek, D. Czerwińska-Kayzer, M.A. Jerzak, *Aktualny stan i wykorzystanie produkcji upraw roślin strączkowych*. *Fragm. Agron.* 2012, 29(4), pp. 45-55, [as in:] A. Rutkowski, *Białkowe bezpieczeństwo kraju ze szczególnym uwzględnieniem żywienia zwierząt monogastrycznych*. *Mat. Komisji Rolnictwa i Rozwoju Wsi*. Warsaw 2012, 45,11-14.

have alternative protein raw materials which could completely replace imported soybean meal. Complete replacement of soybean protein with domestic legume seeds is not possible due to the limited shares of this fodder in diets, especially in compound fodder for poultry and young pigs, and also due to the excessive content of structural carbohydrates (fibres) and anti-nutritional substances (alkaloids, tannins).

According to the CSO data<sup>92</sup>, in 1989 in Poland the total cultivation area of fodder legumes was about 480 thousand ha. This was related to striving for the national self-sufficiency in terms of high-protein components of concentrated fodder. Not without significance was also the international situation creating problems with obtaining high-protein soybean meal. The introduction of the principles of the market economy and easy access to relatively cheap soybean meal affected, in the following years, the development of economic factors and the change in the crop structure. As a result, the cultivation area of fodder legumes decreased significantly, in 1990 by 6.6% – it was 448.9 thousand ha. In 1995-2000, it remained at the similar level of 88.2-98.3 thousand ha while in 2004 it was 70.9 thousand ha<sup>93</sup>.

In the recent years, we may observe the increased interest in the cultivation of native legumes, which largely results from subsidies for the cultivation of these crops. Also, internationally and nationally research and development work is carried out which is aimed at learning the capabilities of legumes, promoting their cultivation and using them in various industries, and especially for fodder purposes. From the CSO data it results that the cultivation area of fodder legumes, due to various interventions, started increasing and amounted to:

- in 2010 – 125.9 thousand ha,
- in 2011 – 119.4 thousand ha,
- in 2012 – 170.6 thousand ha,
- in 2013 – 131.0 thousand ha,
- in 2014 – 152.1 thousand ha,
- in 2015 – 312.9 thousand ha.

The assumed universality of using native legume seeds in fodder will be a reason for which the ultimate cultivation area may amount to 450-500 thousand ha. The cultivation of legumes in this area will allow to replace imported soybean protein in about 50%<sup>94</sup>.

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<sup>92</sup> *Wyniki Spisu Rolniczego 1990*, GUS, Warsaw 1990.

<sup>93</sup> *Wyniki produkcji roślinnej 1995*, GUS, Warsaw 1996 and identical publications for the further years.

<sup>94</sup> *Ulepszanie krajowych źródeł białka roślinnego, ich produkcji, systemu obrotu i wykorzystania w paszach*, Raport końcowy z realizacji Programu Wieloletniego 2011-2015, Puławy 2015.

The increase in the cultivation area of fodder legumes is connected with support in a form of subsidies, which since 2009 has been granted to farmers cultivating high-protein crops<sup>95</sup>. However, little interest in the cultivation of legumes results from a series of production and economic constraints, among which the most common are<sup>96</sup>:

- particular susceptibility of these crops to diseases,
- presence of anti-nutritional substances (tannins, alkaloids) in seeds,
- unstable yields of certain species resulting from the sensitivity of these crops to spring frosts and the absence of water at the stage of seed germination and filling.

These factors have a large impact on the level of yield, which determines the production profitability level. However, after Poland's accession to the EU, various types of payments are introduced to support income achieved from the cultivation of these crops.

**Sweet lupin.** The cultivation area of sweet lupin in Poland in the recent years has been subject to great changes as shown by the data presented in Table 4. In 2005, it was only 28.9 thousand ha from 2012, however, we may observe a gradual increase, in 2015, the area planted with sweet lupin amounted to 207.8 thousand ha.

Table 4. Area of sweet lupin cultivated for seeds in 2005-2015 and the yield of seeds and their sales price

Specification	2005	2010	2011	2012	2013	2014	2015
Growing area of sweet lupin in Poland ha	28,903	75,689	52,508	49,221	64,265	80,022	207,837
Yield of sweet lupin in individual holdings dt/ha	14.4	17.7	15.3	16.0	16.0	17.7	14.1
Selling price of sweet lupin seeds PLN/dt	58.25	71.97	79.44	90.04	93.21	93.22	80.78

Source: own study based on the CSO data.

<sup>95</sup> *Platności bezpośrednie w 2009 r.* <http://www.minrol.gov.pl/Wsparcie-rolnictwa/Platnosci-bezposrednie/Archiwum/Platnosci-bezposrednie-w-2009-r/PLATNOSC-DO-POWIERZCHNI-GRUPY-UPRAW-PODSTAWOWYCH> [access: 18.04.2016].

<sup>96</sup> D. Czerwińska-Kayzer, J. Florek, *Oplacalność wybranych upraw roślin strączkowych*. *Fragm. Agron.* 2012, 29(4), pp. 36-44, [as in:] J. Podleśny, *Rośliny strączkowe w Polsce – perspektywy uprawy i wykorzystanie nasion*. *Acta Agrophysica*, 2005, 6(1), pp. 213-224.

Table 5. Production, costs and gross margin achieved in 2015 from the cultivation of sweet lupin, as the research sample average and as the selected holdings average in the agricultural regions (actual data)

Specification	Average in holdings cultivating sweet lupin	Average in selected holdings in region			
		Pomorze and Mazury	Wielkopolska and Śląsk	Mazowsze and Podlasie	Małopolska and Pogórze
Number of surveyed farms	167	74	45	34	14
Utilised agricultural area [ha]	68.12	81.43	71.04	44.66	45.32
Growing area [ha]	7.14	9.94	5.47	4.80	3.35
Yield of sweet lupin [dt/ha]	14.5	14.4	16.8	11.1	14.0
Selling price of sweet lupin [PLN/dt]	90.54	84.41	103.24	97.06	100.29
<b>Per 1 ha of growing area</b>					
Total value of production [PLN]	1309	1220	1730	1079	1408
Total direct costs [PLN]	529	464	662	502	936
from this: sowing materials	257	230	310	256	403
fertilisers	153	135	221	112	234
organic fertilisers	1	1	-	-	13
plant protection products	106	86	123	129	234
growing regulators	9	10	4	4	39
other	3	3	4	-	13
Gross margin without subsidies [PLN]	780	755	1068	577	472
Total subsidies [PLN]	1232	1216	1248	1269	1274
form this: payment for protein crops	404	397	415	415	415
single area payment	454	454	454	454	454
payment for greening	304	304	304	304	304
additional payment	70	60	74	95	101
Gross margin [PLN]	2012	1971	2316	1846	1746
Total labour input [hours]	5.8	5.0	6.8	7.3	8.1
in this: own labour input	5.4	4.6	6.2	7.1	7.6
<b>Indicators of economic efficiency</b>					
Share of direct costs in gross margin without subsidies [%]	0.68	0.61	0.62	0.87	1.99
Direct profitability indicator [%]	247.4	262.6	261.3	215.1	150.4
Direct costs / 1 dt [PLN]	36.59	32.14	39.51	45.12	66.69
Gross margin without subsidies / 1 dt [PLN]	53.95	52.27	63.73	51.94	33.60
Gross margin without subsidies / 1h of total labour input [PLN]	134.96	152.01	158.18	79.24	58.12
Share of subsidies in gross margin [%]	61.2	61.7	53.9	68.7	73.0

[-] – means that a specific phenomenon did not occur

Source: own study based on the data of the AGROKOSZTY system.

Lupin (like other legumes) is – characterised by fairly large yielding variability, which is determined by the agronomic and habitat factors, in particular, weather ones. In 2015, due to the shortage of rainfall and moisture in the soil, the yield of sweet lupin seeds in individual holdings decreased by 3.6 dt (i.e. by 20.3%), when compared to 2014. The fodder lupin seed buying-in price is



also characterised by the large variability over the years, much greater than the yield. In 2015, it was at the level of PLN 80.78 per dt and when compared to 2014 it decreased by 13.3% – Table 4.

In 2015, as part of the research conducted in the AGROKOSZTY system, the profitability of producing sweet lupin seeds was evaluated. The research was conducted in 167 holdings. The research results were presented as the research sample average and as the average for the groups of holdings selected by regional location. The conducted classification was aimed at determining the level of the gross margin from the cultivation of sweet lupin and the identification of factors determining its level in four Polish agricultural regions, i.e. Pomorze and Mazury, Wielkopolska and Śląsk, Mazowsze and Podlasie and Małopolska and Pogórze – Table 5.

According to the public statistical data, in 2015, the yield of sweet lupin in the individual holdings was 14.1 dt/ha. On average, in the research sample of the holdings it was at almost the same level (14.5 dt/ha). In contrast, in the agricultural regions, its diversification is clearly visible – the yield of sweet lupin ranged from 11.1 dt/ha in Mazowsze and Podlasie to 16.8 dt/ha in the Wielkopolska and Śląsk region.

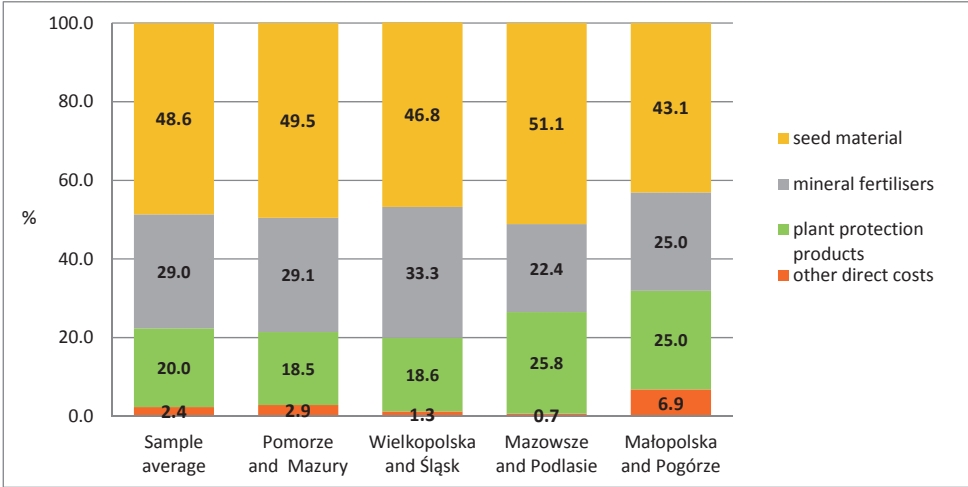
The fodder lupin buying-in price, on average in the country was PLN 80.78 per dt. On the other hand, the price obtained by farmers on average in the analysed holdings was by 12.1% higher, amounting to PLN 90.54 per dt. Its level – just like that of the yield – was diversified regionally. The highest price was obtained by the lupin producers from the Wielkopolska and Śląsk region – PLN 103.24 per dt, and the lowest – those from the Pomorze and Mazury region – PLN 84.41 per dt. From the research it results that in the sample of holdings from each region, the lupin sales price was higher than the national average, unlike the yield, which was lower in two regions. It is estimated that its level was highly determined by regional location of holdings, and thus, the different soil and climatic conditions, not always conducive to the cultivation of lupin.

Regional location of the holdings differentiated both the level of revenues (production value) from the cultivation of sweet lupin and incurred direct costs. When comparing the extreme values, in the first case the differentiation was 1.6-fold, and in the other 2-fold. When it comes to the production value, the highest value (PLN 1,730 per ha) was achieved by the producers in the Wielkopolska and Śląsk region and the lowest (PLN 1,079 per ha) in Mazowsze and Podlasie. In contrast, the highest direct costs were recorded in holdings from Małopolska and Pogórze (PLN 936 per ha) and the lowest in Pomorze and Mazury (PLN 464 per ha).



The structure of direct costs incurred for the cultivation of sweet lupin shows which cost components have the strongest influence on their level. From the research it results that the predominant share in the structure was that of the cost of seed material, on average, in the sample it was 48.6%, and in the agricultural regions it ranged from 43.1% to 51.1%. The smaller share was that of the cost of mineral fertilisers – from 22.4% to 33.3%, while the cost of plant protection products – from 18.5% to 25.8%. The total share of the cost of mineral fertilisers and plant protection products, on average, in the sample was 49.0%, and in the agricultural regions from 47.6% to 51.9%. With some approximation, it may be concluded that in the structure of direct costs of the cultivation of sweet lupin, the cost of seed material accounted for the total of the cost of mineral fertilisers and plant protection products – Figure 5.

Figure 5. Structure of direct costs of the cultivation of sweet lupin in 2015, as the research sample average and as the selected holdings average in the agricultural regions (per 1 ha of the cultivation area)



Source: study based on own research.

In 2015, the cultivation of sweet lupin allowed to obtain the gross margin without subsidies, although it was not high. On average, in the holdings involved in the research it was PLN 780 per ha, while in regional terms it ranged from PLN 472 per ha in the Małopolska and Pogórze region to PLN 1,068 per ha in the Wielkopolska and Śląsk region. Support for lupin producers were subsidies, their total amount per 1 ha was more than PLN 1,200. On average, in the sample, the share of subsidies in the gross margin (with subsidies) amounted to 61.2%. Subsidies constituted the largest support for farmers cultivating lupin in the Małopolska and Pogórze region. This is evidenced by their high share in

the gross margin – 73.0%. In the remaining regions, the share of subsidies in the gross margin ranged from 53.9% to 68.7%.

The role of subsidies as an instrument supporting farmers' income is important. On average, in the holdings from the research sample their total level (PLN 1,232 per ha) was higher by 58% than the gross margin without subsidies (PLN 780 per ha). However, in regional terms, subsidies were higher than the obtained gross margin without subsidies by from 17% in the Wielkopolska and Śląsk region to 170% in the Małopolska and Pogórze region.

In 2015, the direct profitability indicator of production of sweet lupin seeds, on average in the sample was 247.4%. The higher economic efficiency was characteristic of lupin cultivated in Pomorze and Mazury (262.6%) and in the holdings from Wielkopolska and Śląsk (261.3%), while the lowest – in the Małopolska and Pogórze region (150.4%).

Other indicators describing the economic efficiency (i.e. profitability) of the cultivation of sweet lupin in the Małopolska and Pogórze region – against a background of the remaining regions – were also less favourable. This is indicated, *inter alia*, by the high direct cost of production of 1 dt seeds (PLN 66.69) and the high ratio of direct costs to the gross margin without subsidies, which amounted to 1.99. This means that the cultivation of lupin in this region was not cost competitive. In the Pomorze and Mazury region, and in Wielkopolska and Śląsk, the ratio of direct costs to the gross margin without subsidies was the most favourable, it was 0.61 and 0.62, respectively. This means that the share of costs in the generated gross margin without subsidies amounted to 61% and 62%, which indicated the greater competitiveness towards this category of income – Table 5.

In the Małopolska and Pogórze region, the labour-intensity of the cultivation of sweet lupin was the highest (8.1 h/ha), while the lowest was recorded in the Pomorze and Mazury region (5.0 h/ha). The difference in favour of Pomorze and Mazury amounted to 38.3%. This factor affected the level of the labour profitability as illustrated by the gross margin without subsidies per 1 hour of total labour inputs: in the Pomorze and Mazury region – PLN 152.01 and in Małopolska and Pogórze – PLN 58.12. The calculations have shown that the advantage of Pomorze and Mazury at the level of the gross margin without subsidies per 1 ha was 60.0%, while per 1 hour of total labour inputs – 161.5%.

Summing up, it must be concluded that the factor that had a great impact on the amount of the gross margin obtained from the cultivation of sweet lupin was the production value, which is derived from the production and price results. Only in the Małopolska and Pogórze region, the factor that negatively affected and determined its amount were direct costs. From the research it

results that the highest gross margin without subsidies was obtained by producers from Wielkopolska and Śląsk (PLN 1,068 per ha). In that region, the highest was also the profitability of production (63.73 per dt) and labour inputs (PLN 158.18 per h) and the relatively high economic efficiency of production (261.3%). On the other hand, the least favourable situation was that of producers of sweet lupin from the Małopolska and Pogórze region, as shown by the relatively low level of the gross margin without subsidies from the cultivation of 1 ha (PLN 472) and per 1 dt of seeds (PLN 33.60) as well as the lowest labour profitability (PLN 58.12 per h) and economic efficiency of production (150.4%).

**Fodder pea.** The area sown under fodder pea – just like in case of sweet lupin – underwent many changes to changes over the years. In 2015, the total area in the country amounted to 12.0 thousand ha, when compared to 2014 it increased by 7.8 thousand ha (2.8-fold). In contrast, the yield of pea in the individual holdings decreased by 2.8 dt (12.9%). The pea buying-in price was also lower (34.2%) – Table 6.

Table 6. Area of fodder pea for seeds in 2005-2015 and the yield of seeds and seed sales price

Specification	2005	2010	2011	2012	2013	2014	2015
Growing area of fodder pea in Poland ha	4,502	6,151	7,309	14,878	4,484	4,249	12,011
Yield of fodder pea in individual holdings dt/ha	18.3	23.0	18.6	19.4	21.2	21.7	18.9
Selling price of fodder pea seeds PLN/dt	55.53	81.80	86.12	120.74	102.83	109.67	72.18

Source: own study based on the CSO data.

In 2015, the research was conducted whose objective was to learn the profitability of production of fodder pea seeds. In 87 holdings situated across Poland, the data were collected on production volumes as well as on inputs and direct costs incurred for the cultivation of pea. These data allow to calculate the first category of income, i.e. the gross margin. The evaluation covered the production and price results and economic effects of the cultivation of pea on average in the holdings involved in the research and in the groups classified by regional location. The study pointed to the differences in the efficiency of production of pea between the selected groups of holdings – Table 7.

The average results in the country were adopted as a point of reference for the evaluation of the production and price results of pea in the research sample. From the public statistical data it results that the yield of fodder pea on average in the individual holdings in the country amounted to 18.9 dt/ha. On the other

hand, on average, in the research sample of the holdings it was at the level of 26.1 dt/ha, thus, it was higher by 38.1%. In the agricultural regions, the differences are visible, however, in each the yield was higher than the average yield in the country. In the holdings situated in the Małopolska and Pogórze region the yield of pea was the highest – 30.6 dt/ha, while the lowest was in the Wielkopolska and Śląsk region – 24.9 dt/ha.

According to the CSO data, in 2015, the fodder pea buying-in price amounted to PLN 72.18 per dt. The price achieved by farmers on average in the analysed holdings was higher by 38.3% and amounted to PLN 99.80 per dt. Its amount was differentiated regionally but always exceeded the average fodder pea buying-in price in the country. The highest price was achieved by pea producers in Mazowsze and Podlasie – PLN 112.52 per dt, and the lowest in Pomorze and Mazury – PLN 85.42 per dt. These results suggest that farmers sought the opportunities to sell seeds at the highest possible price. It should be added that the research sample included the holdings with commercial production so, at least to a certain extent, the managerial skills of farmers become visible.

The production and price results of fodder pea guaranteed income from 1 ha (the value of potentially commercial production) ranging from PLN 2,273 to PLN 2,823. The lowest results were achieved by farmers from Pomorze and Mazury, and the highest by those from Mazowsze and Podlasie. Regional location of the holdings diversified the level of revenues from the cultivation of fodder peas to a greater extent than the amount of direct costs. When comparing the extreme values, in the first case the difference per 1 ha was PLN 550, and in the other PLN 94. The lowest direct costs of the cultivation of 1 ha of pea were recorded in the Mazowsze and Podlasie region (PLN 845 per ha), and the highest – in Pomorze and Mazury (PLN 939 per ha) – Table 7.

The calculations on the structure of direct costs are presented in Figure 6. The results correspond to those obtained in the research on sweet lupin. In the structure of direct costs of the cultivation of fodder pea, the significant share was that of the cost of seed material, on average in the sample – 47.1%, and in the agricultural regions from 41.5% in Mazowsze and Podlasie to 49.7% in Pomorze and Mazury. The impact of the cost of mineral fertilisers and the cost of plant protection products on the level of total direct costs in total was weaker. Their total share in the structure, on average, in the sample was 52.2% and in the regions it ranged from 49.7% to 57.9%.

Table 7. Production, costs and gross margin achieved in 2015 from the cultivation of fodder pea, as the research sample average and as the selected holdings average in the agricultural regions of Poland (actual data)

Specification	Average in holdings cultivating fodder pea	Average in selected holdings in region			
		Pomorze and Mazury	Wielkopolska and Śląsk	Mazowsze and Podlasie	Małopolska and Pogórze
Number of surveyed farms	87	20	29	20	18
Utilised agricultural area [ha]	58.66	68.61	71.9	42.06	44.73
Growing area [ha]	4.18	4.45	4.75	4.52	2.6
Yield of fodder pea [dt/ha]	26.1	26.6	24.9	25.0	30.6
Selling price of fodder pea [PLN/dt]	99.80	85.42	105.48	112.52	100.29
<b>Per 1 ha of growing area</b>					
Total value of production [PLN]	2604	2273	2623	2823	2530
Total direct costs [PLN]	906	926	939	845	889
from this: sowing materials	427	460	456	351	425
fertilisers	294	266	287	335	287
organic fertilisers	-	-	-	-	-
plant protection products	179	195	190	154	166
growing regulators	5	6	6	1	11
other	1	-	-	4	-
Gross margin without subsidies [PLN]	1698	1347	1685	1979	1641
Total subsidies [PLN]	1236	1169	1239	1279	1270
from this: paym	395	333	415	415	415
single area payment	454	454	454	454	454
payment for greening	304	304	304	304	304
additional payment	83	79	66	105	96
Gross margin [PLN]	2934	2516	2924	3258	2911
Total labour input [hours]	7.0	7.8	6.3	6.3	9.2
in this: own labour input	6.8	7.8	5.7	6.3	9.2
<b>Indicators of economic efficiency</b>					
Share of direct costs in gross margin without subsidies [%]	53.4	68.8	55.7	42.7	54.2
Direct profitability indicator [%]	287.4	245.4	279.5	334.2	284.5
Direct costs / 1 dt [PLN]	34.75	34.81	37.74	33.78	29.03
Gross margin without subsidies / 1 dt [PLN]	65.14	50.61	67.73	79.12	53.56
Gross margin without subsidies / 1h of total labour input [PLN]	241.76	172.51	268.04	315.86	178.66
Share of subsidies in gross margin [%]	42.1	46.5	42.4	39.3	43.6

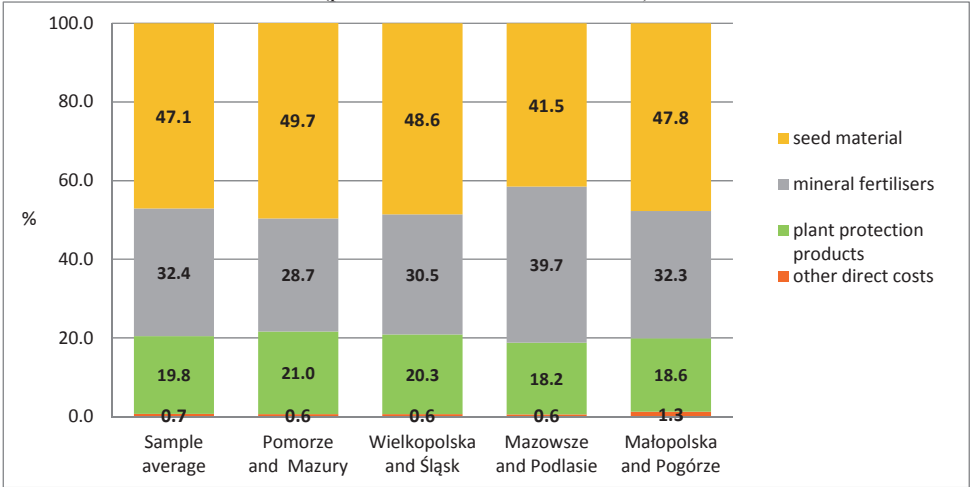
[-] – means that a specific phenomenon did not occur

Source: own study based on the data of the AGROKOSZTY system.

The economic results of the cultivation of fodder pea in 2015 were favourable. As an indicator of the evaluation, the level of the gross margin without subsidies was adopted, on average, in the research sample producers achieved PLN 1,698 from 1 ha and in the agricultural regions from PLN 1,347 in Pomorze and Mazury to PLN 1,979 in Mazowsze and Podlasie. The

determinant of the level of the gross margin was the production value, as a derivative of the production and price results of pea. Additional support were subsidies, their total amount to 1 ha of fodder pea on average in the sample was PLN 1,236 per ha. This means that to PLN 1 of the gross margin without subsidies farmers received support amounting to PLN 0.73. In the agricultural regions, subsidies for fodder pea producers were similar, they ranged from PLN 1,169 to 1,279 per ha. In contrast, subsidies to PLN 1 of the gross margin obtained from production (i.e. without subsidies) ranged from PLN 0.65 in Mazowsze and Podlasie to PLN 0.87 in Pomorze and Mazury.

Figure 6. Structure of direct costs of the cultivation of fodder pea in 2015, as the research sample average and as the selected holdings average in the agricultural regions (per 1 ha of the cultivation area)



Source: study based on own research.

The economic efficiency indicators much more broadly describe the efficiency of production of fodder pea. They also confirm the advantage of the Mazowsze and Podlasie region. The direct profitability indicator of the cultivation of fodder pea in that region was the highest – amounted to 334.2%, this means that the production value exceeded incurred direct costs by 3.3 times. In contrast, in the holdings situated in Pomorze and Mazury the direct profitability was the lowest – 245.4%. However, its level was still relatively high. In the Mazowsze and Podlasie region, direct costs accounted for 42.7% of the generated gross margin. Against a background of the remaining regions, the value of that indicator was the most favourable, which evidences the relatively high cost competitiveness. In addition, the highest was the profitability of production and labour inputs. This is shown by the gross margin without subsidies, which per 1 dt of seeds amounted to PLN 79.12, and per 1 hour of

total labour inputs (including own and hired) – to PLN 315.86. When compared to the weakest results achieved in the Pomorze and Mazury region, it was higher by 56.3% and 83.1%, respectively.

The analysis carried out showed that at the level of the gross margin the cultivation of fodder pea was profitable. The determinant of its amount was the production value, as a resultant of the production and price results. The strength of impact of direct costs was much weaker. The economic results of the cultivation of pea in all regions were favourable. The gross margin without subsidies obtained from one ha of the cultivated area ranged from PLN 1,347 in Pomorze and Mazury to PLN 1,979 in Mazowsze and Podlasie, while after including subsidies it was, respectively in the same regions, from PLN 2,516 to PLN 3,258.

Compared to sweet lupin, the gross margin from the cultivation of fodder pea was significantly higher. This was determined mostly by the higher yield, which in some regions was even two times higher.

**Soybean.** Soybean is one of the most valuable crops used as food for people and fodder for animals. In 2013, the total global production of soybean meal amounted to 199.5 million tonnes. The demand for soybean meal results from the development of animal production but also from a reduction in other sources of protein. Important is also the fact, that as a result of breeding works new varieties of soybean appeared, which allowed to expand its cultivation in areas where previously it was not cultivated. This has led to the increase in the cultivation area of soybean in the world, from 29.5 million ha in 1970 to 111.2 million ha in 2013. Soybean was originally cultivated in China, currently the largest producers are the United States, Brazil, Argentina, China, India, and Ukraine<sup>97</sup>.

Poland annually imports about 2.5 million tonnes of soybean meal, it is mainly genetically modified raw material. The market prices of soybean meal are high. Therefore, farmers debate over a possibility of cultivating this extremely valuable crop in Poland. In the climatic and geographic conditions of Poland, it is possible to cultivate only these varieties of soybean which are grown or tested in terms of their fitness for cultivation. Soybean is a short day plant, with high thermal requirements, therefore, the majority of foreign varieties do not ripen in Poland.

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<sup>97</sup> *Opolszczyzna stawia na soję. 2015.* <http://www.nowiny.pl/agronowiny/105531-opolszczyzna-stawia-na-soje.html> [access: 6.06.206].

Factors supporting the development of the soybean cultivation in Poland:

- steadily growing demand for soybean meal and vegetable oils;
- EU programmes obliging a large number of commercial holdings to reduce intensive production (greening);
- possibility of receiving higher payments for growing “nitrogen-fixing” crops, including those under the so-called “greening”
- no need to supplement the machinery park with specialised machinery and equipment;
- emergence in the domestic market of entities interested in purchasing and processing soybean seeds.

The qualities of soybean have been known since ancient years. Its seeds contain a lot of protein with a high nutritional value. Due to the high content of protein (35-44%) and fat (18-22%), soybean seeds are valuable raw material to produce fodder and food. Therefore, the demand for soybean seeds has been increasing gradually. From the experiments with the cultivation of this plant in various parts of our country, it results that there are great opportunities for its cultivation, particularly in the belt of southern Poland. It should be added that soybean has been cultivated in Poland for many years, but on a small scale. For example, in the experimental fields of the Lublin Agricultural Advisory Centre in Końskowola it has been cultivated for over twenty years. The yield of seeds is at the level of the 2.8-3.5 t/ha<sup>98</sup>.

The cultivation area of soybean in Poland has been increasing gradually. According to the available FAOSTAT data, in 2012 it was 855 ha – Table 8.

Table 8. Area of soybean cultivated for seeds in Poland in 2003-2012

<b>Year of study</b>	<b>Area (in ha)</b>	<b>Year of study</b>	<b>Area (in ha)</b>
<b>2003</b>	447	<b>2008</b>	67
<b>2004</b>	268	<b>2009</b>	127
<b>2005</b>	296	<b>2010</b>	181
<b>2006</b>	294	<b>2011</b>	208
<b>2007</b>	332	<b>2012</b>	855

Source: FAOSTAT. *Food and agriculture organization of the united nations statistics division*. <http://faostat3.fao.org/download/Q/QC/E> [access: 06.06.2016].

In 2015, the research was taken to evaluate the profitability of soybean production in Poland. The research sample covered 53 holdings, in which the data were collected on the volume and value of soybean seed production as well as on incurred inputs and direct costs. The results were presented, on average, in the research sample and in the selected groups of holdings. The criterion of their selection was their regional location. The results of the cultivation of soybean

<sup>98</sup> T. SolarSKI, *Uprawa soi w Polsce*, Raport Rolny 2014, <http://www.raportrolny.pl/pozostale-uprawy/item/2901-uprawa-soi-w-polsce> [access: 06.06.2016].



were presented, on average, in the holdings located in the Wielkopolska and Śląsk region, Mazowsze and Podlasie, and Małopolska and Pogórze. The results were not presented for the holdings in the Pomorze and Mazury region due to the small sample size. The objective of the research – just like in case of the previously discussed production activities – was to determine the profitability of soybean production at the level of the gross margin, and to examine which factors determine its level. As no data are available on the production and price results of soybean according to public statistics in Poland, the analysis covered only the results of own research.

On average, in the holdings involved in the research, the cultivation area of soybean was 5.38 ha, the yield of seeds – 13.1 dt/ha, and the sales price – PLN 117.65 per dt. In the agricultural regions, the cultivation area of soybean was similar, it ranged from 4.64 to 5.85 ha. In terms of the production and price results, the differences are very clear – Table 9.

The highest yield of soybean (15.0 dt/ha) was obtained by farmers in the Małopolska and Pogórze region and the lowest in the holdings from Wielkopolska and Śląsk (11.9 dt/ha); the difference was 3.1 dt. In contrast, in terms of the sales price of soybean seeds, it was the highest in the Mazowsze and Podlasie region – PLN 131.49 per dt. In the remaining two regions, the price of soybean was lower and similar: PLN 114.01-115.04 per dt.

When analysing the results of the cultivation of soybean in the groups of holdings selected according to their location within the region, it has been observed that the production and price results were a factor that determined the level of the gross margin without subsidies. It is confirmed by the fact that the order of the regions both in terms of revenue from the cultivation area of 1 ha (production value) and income at the level of the gross margin was the same. Direct costs affected the amount of the gross margin but did not change the order of the regions.

The production and price results of soybean provided the production value from 1 ha within the range of PLN 1,372-1,810. The lowest was achieved by the farmers from the Wielkopolska and Śląsk region and the highest by those from Mazowsze and Podlasie. On the other hand, the lowest direct costs of cultivating 1 ha of soybean were recorded in the Mazowsze and Podlasie region (PLN 884 per ha), and the highest – in Wielkopolska and Śląsk (PLN 1,204 per ha) – Table 9.

Table 9. Production, costs and gross margin achieved in 2015 from the cultivation of soybean, as the research sample average and as the selected holdings average in the agricultural regions of Poland (actual data)

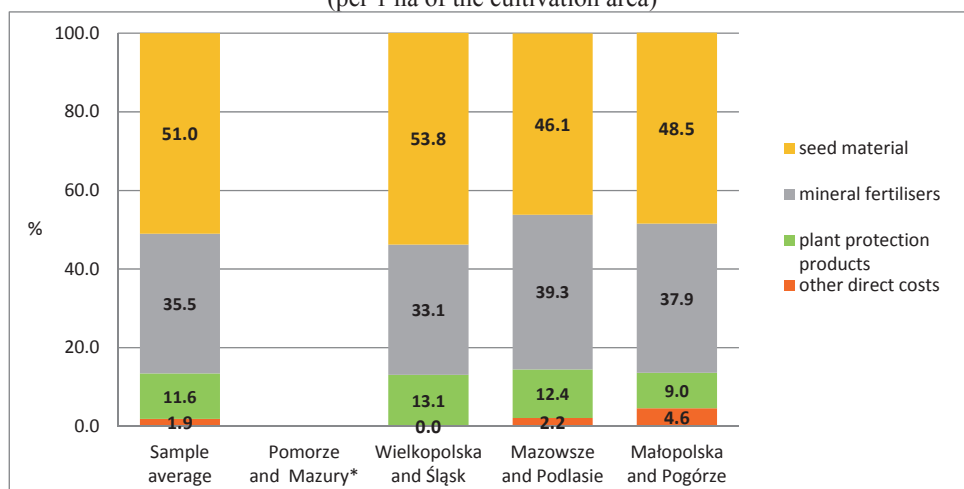
Specification	Average in holdings cultivating soybean	Average in selected holdings in region			
		Pomorze and Mazury*	Wielkopolska and Śląsk	Mazowsze and Podlasie	Małopolska and Pogórze
Number of surveyed farms	53	3	23	10	17
Utilised agricultural area [ha]	63.24		66.74	43.67	64.56
Growing area [ha]	5.38		5.85	4.64	5.35
Yield of soybean [dt/ha]	13.1		11.9	13.8	15.0
Selling price of soybean [PLN/dt]	117.65		115.04	131.49	114.01
<b>Per 1 ha of growing area</b>					
Total value of production [PLN]	1537		1372	1810	1706
Total direct costs [PLN]	1108		1204	884	1135
from this: sowing materials	565		647	407	550
fertilisers	394		399	348	431
organic fertilisers	-		-	-	-
plant protection products	128		158	109	102
growing regulators	12		-	19	27
other	9		0	-	26
Gross margin without subsidies [PLN]	429		168	927	571
Total subsidies [PLN]	1251		1248	1281	1246
from this: paym	415		415	415	415
single area payment	454		454	454	454
payment for greening	304		304	304	304
additional payment	78		75	108	73
Gross margin [PLN]	1680		1416	2208	1817
Total labour input [hours]	6.7		7.6	5.7	6.0
in this: own labour input	6.6		7.4	5.7	6.0
<b>Indicators of economic efficiency</b>					
Share of direct costs in gross margin without subsidies [%]	2.6		7.2	1.0	2.0
Direct profitability indicator [%]	138.7		114.0	204.9	150.3
Direct costs / 1 dt [PLN]	84.84		100.95	64.19	75.88
Gross margin without subsidies / 1 dt [PLN]	32.81		14.08	67.30	38.13
Gross margin without subsidies / 1h of total labour input [PLN]	64.18		22.01	163.24	95.36
Share of subsidies in gross margin [%]	74.5		88.1	58.0	68.6

[\*] – due to the small size of the research sample, presentation of the results was not reasonable

[-] – means that a specific phenomenon did not occur

Source: own study based on the data of the AGROKOSZTY system.

Figure 7. Structure of direct costs of the cultivation of soybean in 2015, on average in the research sample and in the selected holdings in the agricultural regions (per 1 ha of the cultivation area)



[\*] – due to the small size of the research sample, presentation of the results was not reasonable

Source: study based on own research.

In the structure of direct costs of the cultivation of soybean, the largest share was that of the cost of seed material, on average, in the sample it amounted to 51.0%, and in the agricultural regions from 46.1% to 53.8%. The impact of the cost of mineral fertilisers and the cost of plant protection products on the total level of direct costs was weaker. Their total share in the structure, on average, in the sample was 47.1%, and in the regions it ranged from 46.2% to 51.7% – Figure 7.

In 2015, the cultivation of soybean allowed to obtain the gross margin without subsidies. On average, in the holdings involved in the research it was PLN 429 per ha, and in regional terms it ranged from PLN 168 per ha in the Wielkopolska and Śląsk region to PLN 927 per ha in the Mazowsze and Podlasie region. The gross margin from production, i.e. without subsidies was low, therefore, support in a form of subsidies was very important. Their total amount for 1 ha was more than PLN 1,200. As a result, on average, in the research sample, the share of subsidies in the gross margin (with subsidies) amounted to 74.5%. Subsidies had the largest share in support for farmers cultivating soybean in the Wielkopolska and Śląsk region. This is evidenced by their high share in the gross margin – 88.1%. In the remaining regions the share of subsidies in the gross margin were within the range of 58.0-68.6%.

The direct profitability indicator of production of soybean seeds, on average, in the sample amounted to 138.7%. In regional terms, the highest economic efficiency was characteristic of soybean cultivated in Mazowsze and Podlasie (204.9%), the further places were occupied by the holdings from the Małopolska and Pogórze region (150.3%), and Wielkopolska and Śląsk (114.0%).

The existing considerations in a more synthetic form present the calculated values of the economic efficiency indicators. They confirm the advantage of the cultivation of soybean in Mazowsze and Podlasie. The gross margin per 1 dt of seeds compared to the holdings located in the Małopolska and Pogórze region was higher by 76.5%, and in the Wielkopolska and Śląsk region – by 4.8 times. It should be added that in Mazowsze and Podlasie the costs of production of 1 dt of soybean seeds were also the lowest (PLN 64.19) and the ratio of costs to the generated gross margin without subsidies was low (0.95). This ratio was particularly high in the Wielkopolska and Śląsk region – it amounted to 7.17 whereas in the Małopolska and Pogórze region it amounted to 1.99.

The presented results evidence the large regional diversification of the results of cultivating soybean in Poland. When comparing the maximum and minimum values, the difference was: at the level of the yield – 26.1%, seed sales prices – 15.3%, direct costs incurred per 1 ha – 36.3%, and gross margin without subsidies from 1 ha – 451.4%. Despite these differences, at the level of the gross margin without subsidies, the cultivation of soybean was profitable, it amounted per 1 ha from PLN 168 to PLN 927. The factor which had a strong impact on the level of the gross margin were revenues, i.e. the value of potentially commercial production. After adding payments, the gross margin from 1 ha (calculated together with subsidies) ranged from PLN 1,416 in the Wielkopolska and Śląsk region to PLN 2,208 in Mazowsze and Podlasie.

**In organic holdings keeping dairy cows**, it is necessary to provide fodder resources in the holding. Fodder obtained from permanent grassland covers the nutritional needs of cattle to a significant extent. Such a way of rearing dairy cows is beneficial for both the environment and from the point of view of production economics<sup>99</sup>. In 2014, agricultural land with certified organic production and under conversion occupied in total 657.9 thousand ha, which accounted for 6.38% of the EU agricultural land with organic production. The national structure of organic agricultural area was characterised by the high

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<sup>99</sup> I. Radkowska, *Wpływ pastwiskowego systemu utrzymania na dobrostan krów mlecznych*, Wiadomości Zootechniczne, Kraków 2012, pp. 3-10.

share of fodder crops as well as meadows and pastures. Their total area amounted to 67.3% of total organic agricultural area<sup>100</sup>.

Milk production in organic holdings in Poland is concentrated in the regions with lower intensive agricultural production, mainly in the Małopolska and Pogórze region (Table 10). This is related to the specific nature of this region, *inter alia*, relief, high share of grassland and low level of industrialisation. In case of milk production, very important is also the possibility of selling raw material, preferably to the surrounding organic processing plants which may provide producers with favourable sales prices and, on the other hand, the appropriate quantity of raw material for processing. In 2014, processing of organic milk in the Małopolska and Pogórze region (voivodeships: Małopolskie, Śląskie, Świętokrzyskie, Podkarpackie) amounted to 651.7 tonnes, i.e. 59.6% of total processing of organic milk in Poland. The remaining part of that processing was located in the Mazowieckie and Warmińsko-Mazurskie voivodeships<sup>101</sup>.

Animal production in the agricultural holding, including keeping dairy cows, is not only a source of income for farmers, but is also of environmental importance<sup>102</sup>. In attempting to evaluate comprehensively agricultural production in organic holdings, it is worth carrying out not only an analysis of the production and economic results, but also assessing the environmental impact of this production. For the basic evaluation of the environmental sustainability of organic dairy holdings (i.e. environmental friendliness of agricultural production), we may use the following indicators<sup>103</sup>, for example: the share of cereals in the structure of sowings on arable land, the number of groups of crops cultivated on arable land, indicator of coverage of arable land with vegetation in winter and the number of animals kept in a holding per 1 ha of utilised agricultural area.

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<sup>100</sup> *Raport o stanie rolnictwa ekologicznego w Polsce w latach 2013-2014*, GIJHAR-S, Warsaw 2015.

<sup>101</sup> *Raport o stanie rolnictwa ekologicznego w Polsce w latach 2013-2014*, GIJHAR-S, Warsaw 2015.

<sup>102</sup> W. Wrzaszcz, *Poziom zrównoważenia indywidualnych gospodarstw rolnych w Polsce*, Studia i Monografie IERiGŻ-PIB, No. 155, Warsaw 2012, p. 65.

<sup>103</sup> W. Wrzaszcz, *Poziom zrównoważenia indywidualnych gospodarstw rolnych w Polsce*, Studia i Monografie IERiGŻ-PIB, No. 155, Warsaw 2012, p. 67.

Table 10. Production of cow's milk in organic holdings (in hectolitres) in 2012-2014, in Poland and in the selected agricultural regions

Specification	Production of milk (in hectolitres) in organic holdings in years		
	2012	2013	2014
Poland	338,299	273,244	252,367
Małopolska and Pogórze	182,527	173,700	127,889
Pomorze and Mazury	101,109	49,867	85,790
Mazowsze and Podlasie	33,242	28,600	19,705
Wielkopolska and Śląsk	21,421	21,077	18,983

Source: own elaboration based on the Chief Inspectorate of Trade Quality of Agricultural and Food Products' data.

Information on the share of cereals in the structure of sowings on arable land is the statistical indicator of the environmental friendliness of agricultural production, which is characteristic of appropriate crop rotation and the level of biodiversity of agrocenoses<sup>104</sup>. In case of cereals, we should avoid the situation where their share in the structure of sowings exceeds 66%<sup>105</sup>. Another indicator informing of appropriate organisation of crop production in the holding is the number of groups of crops cultivated on arable land<sup>106</sup>. This indicator shows the degree of diversity of the structure of sowings, which evidences the possibility of crop selection and rotation, resulting in the reduced pest population, reduced weed infestation and minimised losses of nitrogen. What is indicated is a need to cultivate at least 3 groups of crops out of the following: cereals, legumes, root, oilseed/industrial, grass of arable land and other crops (not classified into the above groups). The indicator of coverage of arable land with vegetation in winter is one of the agri-environmental indicators determining the degree of the implementation of the sustainable production system in agriculture<sup>107</sup>. The best protection of soil is provided by the highest possible coverage with vegetation in winter, the minimum level of the indicator may be assumed as the coverage of 33% of the area of arable land. That indicator has been calculated as a ratio of the total area of winter crops, cover crops on arable land, grass in the field cultivation for green forage, small-seed legumes for green forage to the total

<sup>104</sup> A. Faber, *Ocena stopnia zrównoważenia rolnictwa w Polsce w różnych skalach przestrzennych*, Studia i Raporty IUNG-PIB, No. 20, Puławy 2010, pp. 9-27.

<sup>105</sup> J. Kuś, *Rola zmianowania roślin w współczesnym świecie*, IUNG, Puławy 1995. p. 34.

<sup>106</sup> E. Majewski, *Ekonomiczno-organizacyjne uwarunkowania rozwoju Systemu Integrowanej Produkcji Rolniczej (SIPR) w Polsce*, Wydawnictwo SGGW, Warsaw 2002.

<sup>107</sup> 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.

area of sowings on arable land. The most important environmental restrictions of animal production relate to the stocking density of animals on utilised agricultural area<sup>108</sup>. The acceptable level of the stocking density of animals on agricultural land should result from the equivalent of a legally permitted dose of manure amounting to 170 kg of nitrogen per 1 ha of utilised agricultural area<sup>109</sup>. For the purposes of this study, we adopted the acceptable level of the stocking density of dairy cows in the organic holding amounting to not more than 2 heads per 1 ha of utilised agricultural area<sup>110</sup>.

In the AGROKOSZTY system in 2015, in individual holdings having the certificate of conformity in organic farming, the research of animal production – **dairy cows** – was carried out. The research sample included 15 holdings keeping dairy cows. The study presented a preliminary evaluation of the environmental sustainability of organic dairy holdings and a comparative analysis of the level of production, incurred inputs and direct costs as well as income in a form of the gross margin per 1 dairy cow. The results were presented as the sample average and in regional terms (apart from the Wielkopolska and Śląsk region) – Table 11.

In organic holdings covered by the research in 2015, the average milk yield of cows was 3,534 litres, and the milk sales price – PLN 1.12 for 1 litre. Compared to the average yield in individual holdings in the country (5,633 litres<sup>111</sup>) that result was worse by 37.3%, while the price obtained by farmers in organic holdings was only slightly lower than the average milk buying-in price in the country (PLN 1.13 per litre<sup>112</sup>). The milk yield of cows and the milk sales price are diversified depending on regional location of organic holdings participating in the research. In terms of the milk yield, the best was the Pomorze and Mazury region, where 1 cow gave 3,839 litres of milk. In the Małopolska and Pogórze region, the milk yield of cows was lower by 5.6%, while in Mazowsze and Podlasie – by 10.3%.

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<sup>108</sup> E. Majewski, *Ekonomiczno-organizacyjne uwarunkowania rozwoju Systemu Integrowanej Produkcji Rolniczej (SIPR) w Polsce*, Wydawnictwo SGGW, Warsaw 2002.

<sup>109</sup> *Act of 10 July 2007 on fertilisers and fertilisation*, Journal of Laws No. 147, item 1033.

<sup>110</sup> *Commission Regulation (EC) No. 889/2008*, Annex IV *Maximum number of animals per hectare referred to in Article 15(2)*, OJ L 250 of 18.9.2008.

<sup>111</sup> *Rynek mleka, stan i perspektywy*, IERiGŻ-PIB, ARR, MRiRW, Warsaw 2016.

<sup>112</sup> *Skup i ceny produktów rolnych w 2015 r.*, GUS, Warsaw 2016.

Table 11. Production, costs and gross margin achieved in 2015 from milk production in organic holdings as the sample average and in regional terms (actual data)

Specification	Average in dairy cow holdings	Average in selected farms in region			
		Pomorze and Mazury	Wielkopolska and Śląsk	Mazowsze and Podlasie	Małopolska and Pogórze
Number of surveyed holdings	15	3	1	4	7
Area of utilised agricultural area [ha]	19.76	24.37		12.04	22.93
Permanent grassland area [ha]	9.89	11.57		3.72	13.12
Share of permanent grassland in UAA [%]	50.1	47.5		30.9	57.2
Fodder area <sup>a</sup> [ha]	0.92	1.12		0.60	0.94
Average annual number of dairy cows	10.0	11.7		5.9	12.2
Milk yield of cows [litre]	3534	3839		3443	3622
Sales price of milk [PLN/litre]	1.12	1.09		0.92	1.18
Sales price of calves weaned from cows [PLN/kg]	10.30	7.46		10.99	11.26
Sales price of cull dairy cows [PLN/kg]	3.85	-		4.24	3.38
<b>Per 1 dairy cow</b>					
Total value of production [PLN]	5075	4780		4150	5512
from this: milk	3973	4191		3183	4298
calf weaned from a dairy cow	823	589		724	938
cull dairy cow	279	-		243	276
Total direct costs [PLN]	1316	1056		1293	1450
from this: herd replacement	416	420		359	417
off-farm fodder	75	6		13	126
on-farm fodder from commercial products	483	185		714	557
on-farm fodder from subsistence products	107	170		16	110
other direct costs	235	275		191	240
Gross margin without subsidies [PLN]	3759	3724		2857	4062
Subsidies <sup>b</sup> [PLN]	1549	1881		1101	1554
Gross margin [PLN]	5308	5605		3958	5616
Total labour input [hours]	198.3	137.2		320.5	190.8
in this: own labour input	196.1	137.2		320.5	186.8
<b>Indicators of economic efficiency</b>					
Direct cost per 1 liter of milk [PLN]	0.37	0.28		0.38	0.40
Gross margin without subsidies per 1 liter of milk [PLN]	1.50	1.46		1.15	1.55
Share of direct costs in gross margin without subsidies [%]	24.8	18.8		32.7	25.8
Share of off-farm fodder costs in total fodder costs [%]	11.3	1.6		1.8	16.0
Use of commercial fodder per 1000 liters of milk [dt]	1.8	0.4		3.1	2.0
Indicator of profitability [%]	385.6	452.8		321.0	380.2
Volume of production/1 hour of total labour inputs [litre]	17.8	28.0		10.7	19.0
Production value/1 hour of total labour inputs [PLN]	25.59	34.84		12.95	28.89
Share of subsidies in gross margin [%]	29.2	33.6		27.8	27.7

<sup>a</sup> Area for production of on-farm fodder.

<sup>b</sup> Subsidies include organic payment, single area payment (SAP), payment for greening and additional payment per fodder area and payment for cows.

\* Due to the small size of the research sample, presentation of the results was not reasonable.

[-] – means that a specific phenomenon did not occur

Source: study based on own research.



From the research it results that farmers from organic holdings could not count on the significantly higher milk buying-in price. In the most favourable situation were farmers from the Małopolska and Pogórze region, where the milk sales price was PLN 1.18 per litre and was by 4.4% higher than the average buying-in price in the country. In contrast, in the Pomorze and Mazury region and in Mazowsze and Podlasie, the price of milk produced in organic holdings was lower by 3.5% and 18.6%, respectively, than the national average milk buying-in price in 2015.

The regionally diversified conditions of milk production in organic holdings affected the specified level of the production value per 1 cow. The highest production value was obtained in holdings from the Małopolska and Pogórze region – PLN 5,512 per cow. This was determined by the best milk sales price. On the other hand, in Mazowsze and Podlasie the level of revenues per 1 cow was the lowest – PLN 4,150. The determinant was both the milk yield of cows and the milk price, which were significantly lower when compared to other regions. The holdings from the Pomorze and Mazury region obtained the production value of PLN 4,780 per cow.

Taking account of direct costs, the research has shown the differences in both their level and the structure. The highest costs – per 1 cow – were incurred by farmers from the Małopolska and Pogórze region – PLN 1,450. Their level was higher, compared to organic holdings in the region: Mazowsze and Podlasie – by 10.8%, and in Pomorze and Mazury – by 27.2%. An important component of direct costs was the cost of fodder (in total), which in the structure of costs depending on the region accounted for 34.1-57.5%. The research has shown a significant diversification of the cost of off-farm fodder and of the cost of on-farm fodder from commercial products. This clearly shows the regional differences in the way of feeding dairy cows. To the greatest extent, purchased fodder was used by farmers from the Małopolska and Pogórze region (mostly concentrated fodder and wet bulk fodder) while in Pomorze and Mazury, and Mazowsze and Podlasie purchases applied only to mineral and feed additives and entailed small costs. In case of on-farm fodder from commercial products, the highest costs were incurred by farmers from Mazowsze and Podlasie. In all groups, farmers commonly used cow's milk (to prepare on-farm fodder), which was associated with the significant cost accounting for, depending on the region, 12.8-27.9% of the total cost of fodder.

When evaluating the economic results of milk production, the level of the gross margin without subsidies per 1 dairy cow has been taken into consideration. According to this indicator, the best situation was in case of the holdings from the Małopolska and Pogórze region, in which the gross margin amounted to PLN

4,062 per cow. This was determined by the highest production value (PLN 5,512 per cow), being a resultant of the relatively good productivity of cows and the best milk price. At the same time, in this region the highest direct costs were incurred (PLN 1,450 per cow), however, they did not have a decisive impact on the level of the gross margin without subsidies. In the Pomorze and Mazury region, when compared to Małopolska and Pogórze, the gross margin without subsidies was lower by 8.3% – it amounted to PLN 3,724 per cow. The weakest result was obtained by organic holdings from Mazowsze and Podlasie, where the gross margin per cow was PLN 2,857. This was determined by the level of the production value (PLN 4,150 per cow) as a derivative of the relatively weakest production and price results.

Additional support for income of farmers in organic holdings were subsidies. In case of the activity focused on dairy cows, account was taken of organic payment, single area payment, payment for greening and additional payment (to which farmers were entitled due to involvement of their own area into production of on-farm fodder) and payment for cows. The analysis showed that support of those subsidies affected significantly the improvement in the income situation of milk production, as evidenced by the share of those subsidies in the value of the gross margin – from 27.7% to 33.6%.

In 2015, milk production in the analysed organic holdings was profitable. The direct profitability indicator calculated as a ratio of the production value to direct costs in percentage terms was adopted as an indicator of profitability. The average level of that indicator in the entire group of analysed holdings amounted to 385.6%. When comparing the results in the selected regions, we may observe the advantage of holdings located in Pomorze and Mazury, in which the direct profitability indicator was the highest – it reached the level of 452.8%. In contrast, in holdings from the Małopolska and Pogórze region, despite the highest production value, the relatively low direct profitability of milk production (380.2%) was recorded, this was determined by the highest costs incurred for keeping dairy cows.

The calculations made show the most favourable income situation of milk production in the Pomorze and Mazury region. The holdings located there achieved the high gross margin without subsidies per 1 litre of milk (PLN 1.46). This is connected with the fact that direct costs of this production were the lowest (PLN 0.28), which could result in the least consumption of bulk fodder per 1,000 litres of milk (0.40 dt). In the Małopolska and Pogórze region, farmers achieved, admittedly, the highest gross margin per 1 litre of milk, but direct costs of its production (PLN 0.40) were by 42.9% higher than in Pomorze and Mazury.

In terms of the economic labour efficiency (also known as labour productivity) the advantage of the Pomorze and Mazury region may be observed. This indicator amounted to PLN 34.84 per 1 hour of total labour inputs and exceeded the level achieved in holdings from the Małopolska and Pogórze region by 20.6%, and from Mazowsze and Podlasie by nearly 2.7 times. Labour inputs were used most effectively in Pomorze and Mazury. This is evidenced by the indicator of technical labour efficient, which amounted to 28 litres per hour and compared to the level achieved in the Małopolska and Pogórze region was higher by 47.4%, and in Mazowsze and Podlasie – by 2.6 times. The diversification of the results describing labour productivity resulted mainly from the differences in labour inputs incurred for keeping cows. In the Mazowsze and Podlasie region, the highest labour inputs were recorded (320.5 h/cow), more than 2.3 times higher than in Pomorze and Mazury (137.2 h/cow).

Based on the information about the structure of crops, utilised agricultural area, arable land and annual average number of cows, *the environmental sustainability of organic dairy holdings has been evaluated*. The first indicator shows the share of cereals in sowing on arable land in the holdings (it should not exceed 66%). This indicator, in case of the sample of organic holdings located in Pomorze and Mazury, amounted to 39.2%, in the Małopolska and Pogórze region – 42.0%, and in Mazowsze and Podlasie – 61.7%. This means that the requirement to guarantee appropriate crop rotation and the level of biodiversity of crops in organic holdings was met. Another indicator is the number of groups of crops cultivated on arable land, which is characteristic of the level of diversity in the structure of crops in the holdings (the need to cultivate at least 3 groups of crops is indicated). From the calculations made based on the variables from databases it results that the requirements were met only by 33.3% of organic holdings in Pomorze and Mazury, while in the Małopolska and Pogórze region – by 57.2%, and in Mazowsze and Podlasie – by 100.0%. Another indicator is the indicator of coverage of arable land with vegetation in winter. In this case, in all analysed regions, the minimum threshold of coverage of more than 33% of arable land in winter has been met, depending on the region, this indicator was from 57.4% to 71.3%.

The last of the indicators refers to the stocking density of animals on utilised agricultural area, it indicates the scale of the negative environmental impact of manure (the stocking density of not more than 2 head per 1 ha has been adopted). After calculating the average annual number of cows per 1 ha of utilised agricultural area, the stocking density was: in Pomorze and Mazury – 0.48 head, Mazowsze and Podlasie – 0.49 head, and Małopolska and Pogórze – 0.53. With such low stocking density of animals, it is not possible to exceed the

allowed dose of manure (equivalent of 170 kg of nitrogen per 1 ha of UAA). The low stocking density of dairy cattle shows the extensive nature of milk production in organic holdings covered by the research.

Summing up, it should be concluded that milk production in organic holdings in all regions made it possible to achieve the gross margin without subsidies. The highest gross margin – PLN 4,062 per 1 cow was achieved in holdings from the Małopolska and Pogórze region. In those holdings, farmers obtained the best milk sales price and the relatively high milk yield of cows. Despite the highest production value, in this region the relatively low direct profitability of milk production was recorded (380.2%), this was determined by the highest costs of keeping cows (PLN 1,450 per cow). The direct profitability indicator was the highest in the Pomorze and Mazury region – it amounted to 452.8%. The advantage of the results in this region is also evidenced by the highest indicator of the technical and economic labour productivity. The lowest gross margin without subsidies was recorded in the holdings in Mazowsze and Podlasie – PLN 2,857 per cow. This was determined by the level of revenues (PLN 4,150 per cow), as direct costs were average (PLN 1,293 per cow), when compared to other regions. The evaluation of the environmental sustainability of organic dairy holdings indicates the significant level of adaptation to the environmental requirements.

### Summary

The chapter presented the results of activities of crop and animal production which in 2015 were covered by the research in the AGROKOSZTY system. In conventional holdings, the subject of the research were: spring barley, maize for grain, table potatoes, sweet lupin, fodder pea and soybean, while in organic holdings – dairy cows. The choice of the activities resulted from the adopted research plan.

The results have been presented as the average for the group of holdings where the research was carried out and for the groups classified by location within the agricultural regions of Poland, i.e. Pomorze and Mazury, Wielkopolska and Śląsk, Mazowsze and Podlasie and Małopolska and Pogórze. The research carried out covered only a certain percentage of the individual holdings in Poland. Nevertheless, it is estimated that in the selected groups it faithfully reflects the direction of the change in the level of costs, gross margin and gives a reliable picture of the changes in the production profitability.

In 2015, the cultivation of **spring barley** at the level of the gross margin was profitable. On average, in the research sample the gross margin research without subsidies from 1 ha amounted to PLN 1,782, and in the groups of

holdings – from PLN 1,542 holdings in the Pomorze and Mazury region to PLN 2,111 in the Wielkopolska and Śląsk region. Its amount was determined by the production and price conditions and direct costs of cultivation. However, when considering the impact of two factors. i.e. revenues and costs, it must be concluded that costs had a decisive influence. Admittedly, high direct costs may change the order of the regions in terms of the amount of revenues and gross margin, however, the former factor has a decisive influence on the level of the gross margin. The results of the cultivation of spring barley were the best in the Wielkopolska and Śląsk region. This is evidenced by the highest gross margin without subsidies (PLN 2,111 per ha) and the economic efficiency of production (321.4%). In this respect, the weakest results were achieved by producers from the Małopolska and Pogórze region and from Pomorze and Mazury. Taking account of support in the form of subsidies (from PLN 828 to PLN 869 per 1 ha), the gross margin per 1 ha as the sample average amounted to PLN 2,621, and in the regions from PLN 2,374 in Pomorze and Mazury to PLN 2,939 in Wielkopolska and Śląsk.

In 2015, the cultivation of **maize for dry grain** was profitable. The highest gross margin was achieved by maize producers in the Pomorze and Mazury region – PLN 2,461 per ha. The weaker results were achieved by producers from Mazowsze and Podlasie – PLN 1,902 per ha. In contrast, in the Małopolska and Pogórze region and in Wielkopolska and Śląsk, the results were even weaker, the gross margin without subsidies from 1 ha was PLN 1,728 and PLN 1,582, respectively. The factor which determined the level of the gross margin was the production value. After adding all subsidies, the gross margin (calculated together with subsidies), on average in the sample was PLN 2,620 per ha, and in the groups of holdings from PLN 2,384 per ha in the Wielkopolska and Śląsk region to PLN 3,268 per ha in Pomorze and Mazury. The share of subsidies in the gross margin amounted from 24.7% to 33.6%. In the Pomorze and Mazury region, the economic efficiency of maize production was the highest, the direct profitability indicator amounted to 271.8%, whereas in the remaining regions it was within the ranged of 178.1-187.2%. The advantage of maize cultivated in the Pomorze and Mazury region is also indicated by the lowest cost of production of 1 dt (PLN 24.10) and the highest profitability of production (PLN 41.41 per dt) and labour inputs (PLN 337.22 per h). The second place, given the favourableness of those indicators, was occupied by the Mazowsze and Podlasie region. In contrast, the weakest results were recorded in the holdings located in the Wielkopolska and Śląsk region, and in Małopolska and Pogórze.

In 2015, the cultivation of **table potatoes** at the level of the gross margin was very profitable. On average, in the research sample of the holdings, the gross margin without subsidies from 1 ha was PLN 10,861. In the agricultural regions, the significant range of its amount was recorded, by comparing the extreme values the difference was PLN 3,693. In the holdings located in the Mazowsze and Podlasie region from 1 ha of potatoes the highest gross margin was achieved – PLN 12,928. In contrast, the further positions were occupied by the regions: Wielkopolska and Śląsk – PLN 11,080, Pomorze and Mazury – PLN 10,057, Małopolska and Pogórze – PLN 9,235. The decisive impact on the level of the gross margin was exerted by revenues (i.e. the value of potentially commercial production), only in the Małopolska and Pogórze region the factor which had quite a strong negative impact on its amount were direct costs (which were the highest in that region). Producers were entitled to receive subsidies for the cultivation of table potatoes, however, the importance of those subsidies was insignificant. This is evidenced by their share in the gross margin with subsidies, which ranged from 6.3% to 8.6%. The results of the research showed that the efficiency of production of table potatoes in the Mazowsze and Podlasie region – against a background of the remaining regions – was the highest. This is evidenced by, *inter alia*, the highest direct profitability indicator (568.2%), the lowest direct cost of production of 1 dt of potatoes (PLN 11.22) and the highest profitability of production (PLN 52.55 per dt). In this respect, the least favourable results were brought by the cultivation of table potatoes in the Małopolska and Pogórze region.

The gross margin without subsidies achieved from the cultivation of 1 ha of **sweet lupin**, on average, in the research sample of the holdings was at the level of PLN 780, whereas in regional terms it ranged from PLN 472 in the Małopolska and Pogórze region to PLN 1,068 in the Wielkopolska and Śląsk region. The factor that had the greatest impact on the amount of the gross margin from the cultivation of sweet lupin was the production value. Only in the Małopolska and Pogórze region the factor which had a negative impact on and determined its amount were direct costs, which were 2 times higher than the gross margin without subsidies, while in other regions they accounted for from 61% to 87% of its level. Support by means of subsidies was very important, their level for one ha of lupin was from PLN 1,216 to PLN 1,274. This means that subsidies exceeded the gross margin achieved from production (i.e. without subsidies), on average in the research sample by 58%, and in the regions from 17% in Wielkopolska and Śląsk to 170% in Małopolska and Pogórze. The economic results of the cultivation of sweet lupin in the holdings in the Małopolska and Pogórze region were the least favourable. This is evidenced, *inter alia*, by the lowest profitability



of production (PLN 33.60 per dt) and labour inputs (PLN 58.12 per h) and the economic efficiency of production (150.4%). The best results in this respect were achieved from the cultivation of sweet lupin in the Wielkopolska and Śląsk region and in Pomorze and Mazury.

When compared to sweet lupin, the gross margin without subsidies obtained from the cultivation of **fodder pea** was higher. This was mainly determined by the higher yield, which in some regions was even two times higher. On average, in the research sample, the gross margin without subsidies from 1 ha of pea was PLN 1,698 and in regional terms from PLN 1,347 in Pomorze and Mazury to PLN 1,979 in Mazowsze and Podlasie (the factor that determined its amount was the production value). In contrast, after adding subsidies (from PLN 1,169 per ha to PLN 1,279 per ha), respectively, in these same regions it ranged from PLN 2,516 to PLN 3,258. The efficiency of production of pea in the Pomorze and Mazury region – against a background of the remaining regions – was relatively low. This is evidenced by the largest share of costs in the gross margin without subsidies (68.8%), the relatively low direct profitability indicator (245.4%) and the lowest profitability of production (PLN 50.61 per dt) and labour inputs (PLN 172.51 per h). At the same time, these indicators confirm the advantage of the holdings from Mazowsze and Podlasie. In this region, the share of costs in the gross margin without subsidies amounted to 42.7%, the direct profitability indicator – 334.2%, and the profitability of production and labour PLN 79.12 per dt and PLN 315.86 per h, respectively.

In 2015, the cultivation of **soybean** allowed to obtain the gross margin without subsidies. On average, in the research sample the gross margin obtained from 1 ha amounted to PLN 429. In contrast, in the Wielkopolska and Śląsk region it was PLN 168 per ha, in Mazowsze and Podlasie – PLN 927 per ha and in Małopolska and Pogórze – PLN 571 per ha (the results for the Pomorze and Mazury region were not presented due to the small number of holdings in the research). The regional differences were high, the factor that had a strong impact on the level of gross margin was the production value which is a resultant of the production and price results. When comparing the maximum and minimum values, the regional difference in the yield was 26.1% and, in case of the seed sales price – 15.3%. Subsidies were of great importance for producers of soybean. On average, in the sample, support for PLN 1 of the gross margin without subsidies amounted to PLN 2.92 while in the Wielkopolska and Śląsk region it was PLN 7.43, in Mazowsze and Podlasie – PLN 1.38 and in Małopolska and Pogórze – PLN 2.18. The results of the cultivation of soybean in the holdings in the Mazowsze and Podlasie region were the best. This is

evidenced by the highest gross margin without subsidies per 1 dt of seeds (PLN 67.30) and the economic efficiency of production (the direct profitability indicator amounted to 204.9%). The least favourable values of those indicators were recorded in the Wielkopolska and Śląsk region (PLN 14.08 and 114.0%, respectively).

The analysis of the results of **milk production in organic holdings** showed that the regional location of the holdings differentiated the level of the production value (revenues) to a greater extent than the level of direct costs incurred for keeping dairy cows. As a result, the order of the regions in terms of achieved revenues and the gross margin was the same. The highest gross margin without subsidies – PLN 4,062 per cow was obtained in the holdings of the Małopolska and Pogórze region. This was determined by the best milk sales price and relatively high milk yield of cows. In the Pomorze and Mazury region, the gross margin without subsidies per 1 cow was PLN 3,725, and in Mazowsze and Podlasie – PLN 2,857 (the results for the Wielkopolska and Śląsk were not presented, the research included only one holding). In contrast, on average, in the research sample, it amounted to PLN 3,759 per cow. Various types of subsidies could be received for milk production in organic holdings, their total amount in regional terms ranged from PLN 1,101 to PLN 1,881 per cow. The share of those subsidies in the gross margin (with subsidies) ranged from 27.7% in the Małopolska and Pogórze region to 33.6% in Pomorze and Mazury. The profitability indicator of milk production was the highest in the Pomorze and Mazury region – it amounted to 452.8%. This means that inputs incurred were used most efficiently. In this region, the smallest (18.8%) was also the share of costs in the generated gross margin without subsidies, which evidences the high cost competitiveness. The most favourable values were also adopted by the indicators illustrating the technical (28 l/h) and economic labour productivity (PLN 34.84 per h). In contrast, the least favourable values of those indicators were recorded in the sample of the holdings from the Mazowsze and Podlasie region.



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## SUMMARY AND CONCLUSIONS

Development of Polish agriculture, starting from the 1990s, and particularly since the middle of the first decade of the current century instilled optimism until recently. However, unfavourable climate changes taking place since the 1980s, effects of third wave of globalisation started in 1980 and events in the European Union taking place since 2008 have strengthened the uncertainty as to its future.

In 2015, in order to provide an answer to the question about the effect of these phenomena on further evolution of domestic agriculture an implementation of research project entitled “Agricultural company and agricultural holding towards climate and agricultural policy changes” has been started, being a part of the governmental research programme entitled “The Polish and the EU Agricultures 2020+. Challenges, chances, threats, proposals”, the implementation of which will be completed in 2019.

The presented monograph contains the research findings of the 2<sup>nd</sup> stage of implementation the above research project. Findings of this two-year research and other partial research, which will be implemented in 2017 and 2018, will become a basis of the summary study to be published in 2019.

The presented monograph focuses on agricultural holdings owned by natural persons. Some of them are households with agricultural production, while others possess characteristics of companies. A third group located somewhere between these groups may also be distinguished. It is supplied in numbers by developing farms of the former of the groups mentioned above, at the same time itself being a cradle for farms with the characteristics of companies.

The monograph contains four types of analyses which are characterised by significant aspects of functioning of farms. Such an approach required each time the use of source materials relevant to a given problem and specific methods of their analysis. Conclusions drawn from prepared analyses are specified below.

- The analysis dealt with the smallest agricultural farms (with the economic volume of up to EUR 4 thousand of SO) mainly on the basis of findings of the research concerning the structure of agricultural farms carried out by the Central Statistical Office in 2013. This is the most numerous group of Polish agricultural farms owned by natural persons (47.3% of the total number). They have small stock of assets and achieve small sizes of production, a part of which is intended for own needs of holders of farms and their families. Thus, they are referred to as small or semi-subsistence farms. On the other hand, they have relatively high

labour force. Their holders and members of their families actively look for and find income from other sources. It shows that income from farms with the maximum size of EUR 4 thousand of SO does not satisfy their aspirations.

Small income from a farm limits not only interest in modernisation and increasing the value of assets, but even in conducting agricultural production in a manner increasing the value added production. An important cause of latter phenomena is the fact that approximately 69% of managers of small farms does not have a formal preparation for the farmer profession and it is a significantly worse situation than that observed in wholly commercial farms.

A problem of farms with the maximum size of EUR 4 thousand of SO is not only the lack of motivation of holders and insufficient knowledge they possess, but also the lack of free capital and possibility to get a loan. It results in depreciation of owned property and is an important cause of reducing the number of agricultural farms of the characterised size. Only in the period of 2010-2013 their number decreased by 13.3%.

Similar phenomena, though less intense, took place also in farms with the size of EUR 4-15 thousand of SO. There are, however, premises indicating that a part of loss in the number of these farms was caused by transition to the group of wholly commercial farms because they managed to increase to a sufficient extent the value of owned assets. Nationwide, the characterised issue refers to ca. 1,100 thousand agricultural farms, namely to 79.1% of their total number of farms owned by natural persons in 2013.

Projection of long-term trends result in three observations referring to significant barriers for the development in the 2025 perspective. This means that the business risk will increase due to a fragile socio-economic policy in many countries of the world (in fact – due to interferences caused by twists in their internal policies), including countries of the European Union. In addition, unfavourable climate changes will not be stopped, and the growth rate of prices of means of production will be larger than of prices of agricultural products.

The above suggestions combined with an analysis of the most important medium-term and short-term trends made it possible to formulate comments referring to the situation of semi-subsistence farms in Poland in the perspective of 2025.

It is beyond doubt that the work offered in non-agricultural sectors of national economy and wage level will be of the biggest importance for holders of characterised farms and their families. Increase in the number of offered workplaces and the amount of remuneration will be a result of: aging of our society, restoring a prior retirement age, successful implementation of “Responsible De-

velopment Plan”, limitation of immigration and investment projects implemented using external capital.

In such a situation, in the middle of the next decade, we should expect: a greater pace of loss in the number of semi-subsistence farms, decline in interest of their holders (limited anyway) in extended reproduction of owned property and takeover of the land released by larger, commercial farms. Moreover, it cannot be excluded that in such a situation some holders of farms currently recognised as commercial will lose their interest in development of owned production property and will take up employment outside the farm.

The ageing of the Polish society is an objective phenomenon and will affect the labour market and rates of pay. In spite of that, the above characteristics of change in the situation of semi-subsistence farms may be changed, if other factors shaping the labour market and wage level will evolve differently than assumed. If, for example, “Responsible Development Plan” will begin to bring announced effects with a delay, or when it appears that the limited inflow of external capital to Poland recorded in the first half of 2016 will prove to be a permanent phenomenon. In such a case, having a small farm will continue to be important, because it will provide an additional source of income offering the possibility of survival in the period between loss of one employment and finding another job. Then, transformations of agrarian structure will not occur faster than currently.

In relation to the present situation, a small change in the 2025 perspective is also possible in demand for products of agricultural origin. Changes in demand will be, however, of limited relevance for semi-subsistence farms because income from agriculture of their vast majority have only side effects on total income of families of holders. Changes in demand will affect, however, a small part of semi-subsistence farms which improve the production process and invest so as to increase income from this source.

Reduction in revenue from direct subsidies may be exceptionally acute for families of holders of semi-subsistence farms. It is because income of these farms largely depends on them.

Effects of climate warming, that have been observed in our country for a few dozen years, such as increasing number of droughts, floods and hurricanes are also a threat. On the areas of the Polish Lowland, stretching from the west to the east between the southern and the northern part of the country (ca. 39% of the territory of Poland), draughts pose the largest threat for farms with soils of poor quality.

Their effects are even more severe, since extra charges only partially compensate for losses incurred by the farms due to this reason. On the lowland areas the level of these subsidies is the smallest.

Agricultural farms will thus be forced to make on their own activities increasing water resources available for crops. It is, however, difficult in semi-subsistence farms. The balanced use of organic fertilisation of fields, increasing soil retention, is hindered by the lack of livestock in most of these farms, and creation of forest strips restricting water evaporation is hindered by the small area of available land. Agrimelioration treatments on dense soils require, on the other hand, the use of expensive services.

Hence, public funds on subsidies for farms running agricultural production will be necessary in the indicated areas as well as funds for reconstruction damaged devices of the so-called small retention (gates on the streams, devices damming up water formerly used by water mills, etc.) and construction of new relevant devices. Such undertakings outside the water collected for the purpose of irrigation of agricultural cultivations will also have such an advantage, since they will reduce the scale and the scope of damages caused by local floods.

The risk of management in more and more difficult natural conditions may limit obligatory, that is relatively cheap, insurance of cultivations against the effects of extreme weather events. It is also necessary to amend the Act supporting rights of lessees using land released as a result of liquidation of agricultural farms.

It would limit expenses lessees incur for purchase of land and would allow them to allocate funds they saved for modernisation of other material resources of farms and expansion of production carried out thereby.

- An often repeated opinion that farms carrying out production in less-favoured areas are characterised by unfavourable financial standing and inadequate opportunities for development was verified. In 2014, subsidies related to carrying out agricultural production in less-favoured areas (LFAs), covered 52.2% of utilised agricultural area submitted by agricultural producers for subsidies under single area payment. This problem is thus of significant practical importance.

The analysis dealt with farms covered by monitoring of the Polish FADN of more than EUR 4 thousand of SO operating in the characterised areas in the period of 2006-2014 as compared to the remaining farms. According to the binding Polish law there are 4 types of less-favoured areas.



- Lowland areas which are characterised by an unfavourable level of the agricultural production space valuation ratio<sup>113</sup>, small population density and small share of farming population. Depending on the intensity of these characteristics less-favoured areas I and II were defined.
- Areas with specific natural difficulties including communes and geodesic precincts where at least 50% of used arable lands are located 350 metres above sea level or higher and which are additionally characterised by specified characteristics, for example share of permanent grasslands exceeding 40% of used land.
- Mountainous areas including communes and geodesic precincts where at least 50% of used arable lands are located 500 metres above sea level or higher.

In addition, the areas particularly affected by droughts were defined. These were communes where draughts during the vegetation period occurred in at least eight of nine years covered by the analysis (2006-2014).

It was observed that:

- Farms from lowland LFAs type I had little lower return on equity ratio and little lower technical performance indicator than farms from outside LFAs type I, but were characterised by extended reproduction of fixed assets and a higher rate of its reproduction. Therefore, farms located in LFAs type I cannot see any possibility for them to operate in the future. However, there are exemptions from these averaged observations. A slightly worse situation was present in agricultural farms of specific types and the size of up to EUR 25 thousand of SO, and it means that this situation affected even smaller commercial farms.
- Farms from lowland LFAs type II, with specific difficulties, mountainous and particularly affected by droughts are characterised by a significantly smaller return on equity ratio, small technical performance ratio and a negative ratio of reproduction of fixed assets. In such cases, investing free financial resources in own farms was not profitable, which, in the situation of lack of favourable change in the level of financing after 2020, would call into question the functioning of farms in these areas in the present form. Such observation concerns also farms with the size of EUR 15 thousand of SO and more.

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<sup>113</sup> The ratio enables for complex evaluation of: quality of soils, their suitability to cultivate particular plant species or their groups, usefulness of agroclimate for agricultural production, water relations in soil and vertical relief.



Opening possibilities of finding quite well paid job beyond the owned farm will encourage holders of a large part of farms from LFAs, even those currently commercial, to take up a paid job with all consequences of this phenomenon for organisation and profitability of managing a farm. This phenomenon may have a milder course, if rates of subsidies for farms located in LFAs are increased accordingly.

- The notion of gardening covered horticulture and production of vegetables. Poland is a major producer of fruit and vegetables in the European Union. In 2013, it occupied the fourth place with the 6.7% share of fruit and the 7.7% share of vegetables, and both types of production and their products play an important role in foreign trade of the country. Their share in the total value of export of agri-food products in 2012-2015 amounted to 8.5% and 4.0%, respectively.

Special attention should be paid to the competitiveness of Polish horticultural farms as compared to the competitiveness of farms from other selected EU Member States. The degree of competitiveness was measured using  $W_k$  competitiveness index according to Werner Kleinhans. It is a quotient of the amount of income from the agricultural farm and the sum of opportunity costs of one's own: land, labour and equity. It has been adopted that  $1 \leq W_k < 2$  informs about the competitive capacity, and  $W_k \geq 2$  about full competitiveness.

The analysis of empirical materials covering the years between 2011 and 2013 showed the competitive capacity was typical in domestic orchard farms with the economic volume of EUR 25-50 thousand and EUR 50-100 thousand of SO. It was also determined that such capacity was also characteristic for: French farms with the size of EUR 25-50 thousand of SO, Hungarian and German farms with the size of EUR 50-100 thousand of SO, Hungarian, Romanian, German, French and Spanish farms with the size of EUR 100-500 thousand of SO and Italian farms with the size of EUR 500 thousand and more of SO.

Polish vegetable farms demonstrated competitive capacity for farms with the economic size of EUR 50-100 thousand of SO and EUR 100-500 thousand of SO. In Hungary such capacity was demonstrated by farms with the size of EUR 8-25 thousand of SO, and competitiveness was demonstrated by those with the size of EUR 25-500 thousand of SO. Moreover, the competitive capacity was typical in the following farms: Romanian with the size of EUR 25-50 thousand of SO, German with the size of EUR 100-500 thousand and EUR 500 thousand and more of SO, French with the size of EUR 100-500 thousand of SO and Italian and Spanish farms with the size of EUR 500 thousand and more of SO.

It results from the above that domestic semi-subsistence farms, even these with the size of up to EUR 15 thousand of SO do not have the competitive capacity, and are not competitive as compared to agricultural farms in the other EU countries.

Apart from this, the differences were also observed in the intensity of production, productivity of land and labour efficiency in Polish farms as compared to the situation of similar farms in the compared countries, which were an outcome of different level of land price, labour cost and production structure by type.

Changes in land prices and, first of all, labour costs in Poland in the 2025 perspective as compared to their changes in the compared countries will thus affect the differentiation of the competitiveness of Polish horticultural farms, but only in the case of production of goods of the same kind. Therefore, horticulture production will more and more often become Poland's specialisation.

- The last group of applications relates to: soil productivity measured by the value of direct surplus calculated without subsidies per 1 ha of cultivation area calculated for selected goods in all four macroregions of the country, an analogical ratio calculated taking account of direct subsidies, as well as production profitability of selected goods in all macroregions of the country measured by relation of direct costs to the value of direct surplus in these macroregions. These values were calculated on the basis of materials from 2015. The conclusions specified below are only those resulting from the soil productivity measured by the value of direct surplus calculated without additional payments and calculated per 1 ha.

- In the case of spring barley the relation of characterised ratio between macroregions on end positions amounted to 36.9%.
- In the case of maize harvested for grain a maximum of 1.6-times difference of the characterised ratio was recorded.
- Very high land productivity was recorded for the production of edible potatoes, and differences in the value of this index between macroregions on end positions amounted to 40.0%.
- Much lower than in the case of all three products mentioned above were the values of the characterised ratio calculated for production of seeds of sweet lupine, and, in addition, as much as the maximum of 2.2-times difference between macroregions of the country was recorded for them.
- Production seeds of fodder peas (field pea) allowed to achieve the amount of the analysed index larger than for the production of sweet lupine seeds, and in some macroregions they were even slightly higher than for the production

of barley and maize seeds. A maximum difference of the analysed index between macroregions of the country amounted to 46.9%.

- The average size of direct surplus calculated without additional payments per 1 ha of cultivation area for soybean cultivation was even slightly lower than in the case of production of seeds of sweet lupine, and the relation of this ratio between macroregions on end positions amounted to 5.5.

In the above-cases the value of direct surplus calculated without additional payments per 1 ha of cultivation area was affected, first of all, by component elements of the production value, namely yield and price. The value of direct surplus calculated without additional payments in the case of keeping milk cows in organic farms was calculated per 1 ha of the main forage area. A maximum difference of this ratio between macroregions of the country amounted to 62.1%. However, the determinations do not take account of the macro indicator.

The above determinations provide the basis for formulating a conclusion that any possible limitation of the level of subsidies in the next EU financial perspective will accelerate the process of specialisation of agricultural production between macroregions of the country. However, this process will be moderated by genetic and agrozootechnical progress.

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