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THE ECONOMIC AND SOCIAL CONDITIONS OF THE DEVELOPMENT OF THE POLISH FOOD ECONOMY FOLLOWING POLAND`S ACCESSION TO THE EUROPEAN UNION

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FOREWORD

The articles in this collection present the research concept, the features of sustainable agriculture and selected results of analyses of data of the Central Statistical Office and FADN – Farm Accountancy Data Network, relating to the agricultural holdings meeting the criteria of the environmental and production sustainability.

The results of analyses conducted on the population of organic holdings have also been presented (i.e. holdings with a certificate or during the transformation into organic production) and of self-supply holdings, which constituted a large group in the Polish agriculture.

The studies published in this collection have been selected from among 25 articles published in four scientific booklets entitled „The research on the socially sustainable agriculture".

This collection includes the following studies:

1. *„The concept of research on socially sustainable agriculture"– Prof. Józef St. Zegar Ph.D.,* (issue 1, Warszawa 2005).
2. *„Features of sustainable agriculture" – Prof. Stanisław Krasowicz Ph.D.* (issue 1, Warszawa 2005).
3. *„Sustainability of private farms in the light of selected criteria"– Prof. Józef St. Zegar Ph.D., Wioletta Wrzaszcz MSc.,* (issue 4, Warszawa 2007).
4. *„Subsistence agricultural holdings and the sustainable development of agriculture" – Prof. Józef St. Zegar Ph.D.,* (issue 3, Warszawa 2006).
5. *„Sustainable farms in the light of the FADN data" – Wioletta Wrzaszcz MSc.*, (issue 2, Warszawa 2006).
6. *„Description of organic holdings in Poland" – Prof. Józef St. Zegar Ph.D.* (issue 2, Warszawa 2006).

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THE CONCEPT OF RESEARCH ON SOCIALLY SUSTAINABLE AGRICULTURE

1. Introduction

The research task entitled „Socially sustainable agriculture" is conducted within the long-term programme „Economic and social conditions of the development of the Polish food economy after the accession of Poland to the European Union", established by the Resolution No. 126/2004 of the Council of Ministers of 18 May 2004. The period of this programme realization, including also the subject research task, was established for the years 2005-2009. The research problem is relatively new and in connection with this it is far from being recognized regarding its essence, characteristic features, scope and method of presentation. For this reason much more attention is paid to the concept of socially sustainable agriculture itself and designing analyses that as an effect would lead to achieving the research targets. In particular the final „product" should be a report placing the model of socially sustainable agriculture in the social and economic development of agriculture and rural regions, indicating the advantages and disadvantages of such agriculture in specific conditions, showing the weak and strong sides of agricultural holdings meeting the criteria of sustainability, summing up the results of the empirical research, as well as containing recommendations for political institutions in the scope of such model of agriculture.

In this article we will discuss the main elements of the research construction, starting from the theoretical issues, namely the notion and features of the socially sustainable agriculture model and certain premises of choosing the political option of agriculture development. Next we will describe the levels of research (vertical aspect), the possibilities of using the available empirical bases and research methods. Finally we will discuss some methodological problems that have been identified during recognizing the problem and need to be worked out.

2. The notion and features of socially sustainable agriculture

Provisionally under the notion of socially sustainable agriculture we will understand such agriculture that meets best certain threshold values in the scope of the economic, environmental and social criteria. Gradually – by observation and analysis of the empirical data and theoretical studies – we will develop and specify this notion. Striving for the maximization (optimization) of values of features meeting the economic, ecological (environmental) and social criteria gives rise to the phenomenon of competition between them. A specific method of organization and production (technology) may maximize the value of the function of the aim according to one criterion, but minimize according to another one (e.g. fertilization vs. the ecological criterion). The issue therefore comes down to establishing the features (variables) that should be taken into account in the function of the aim and marking the threshold values in the scope of those variables. It appears that **the model of socially sustainable agriculture should at the same time meet the criteria (threshold values) in the three mentioned areas: the economic, ecological and social area**. In other words, the set of socially sustainable holdings constitutes a subset of the whole population of holdings meeting the threshold criteria established for selected economic, environmental and social features.

The issue of the selection of features expressing the level of sustainability of an agricultural holding is the subject of numerous discussions and controversies. So far the attempts to develop a uniform set of sustainability indexes (eco-development indexes) both in relation to the whole economy, as well as agriculture (holdings) have not brought even one set and still these indexes are subject to dissent (however a certain broad set of sustainability indicators „functions" both within the EU, OECD, as well as in some countries). To a great extent this results from the local character and context of the agricultural activity on the environmental plane, as well as, to a smaller extent, on the social and economical plane. An additional difficulty are the criteria used in practice by institutions dealing with support for agricultural holdings (this is expressed in differences between an ordinary agricultural practice and a good agricultural practice) and lack of such criteria in relation to the social and partly economical sphere.

In relation with the **economic features,** we assume the income categories as the basic ones. In the microeconomic scale this will be the provision of a satisfactory income (for a family, user), assuming provisionally that this satisfaction is connected with the relation of the income to the income of other social and professional groups. In the macroeconomic scale this will the volume

of the generated gross value added (GVA), gross income at disposal (GIaD) and the value of agricultural production, including in particular the commodity production.

In relation to the **environmental features** as the most important we regard those that comprise the code of good agricultural practices, however we also take into consideration the legal and administrative criteria adopted while giving support from the public funds (usual agricultural practices). It cannot be excluded that the analysis of empirical data of holdings meeting the criteria of good agricultural practices will indicate the usefulness of a critical approach to them in the economic aspect, and at the same time a certain verification of them.

In relation to the **social features** as the most important we consider such as the value of environmental services created by agriculture (holdings), the usage of agricultural work resources, contribution in maintaining or developing the economic and social vitality of villages and the cultural values.

3. Premises of the socially sustainable agriculture model

The dominant trend of development is at present striving for accelerating the economic growth, measured by GDP, which is made by strengthening the intensiveness of managing in order to maximize the economic advantage. A new element in this process is a small change of accents from the capital intensification (in the conventional understanding) for the usage of knowledge. In the global scale still the intensification is followed by an increased engagement of natural resources and gives rise to many new social problems. In the economic sphere the competition spiral is wound up: production surpluses in the global market → competition pressure → concentration and consolidation → increasingly powerful international corporations (controlling the product markets) → decreasing field of farmers' decisions → decreasing share of agriculture in the final price of food products. In the environmental sphere great global problems are growing, and among them the most important are: a) the problem of water degradation and shortage of water for agriculture and municipal needs; b) the problem of environmental services created by agriculture (biodiversity, climatic changes); c) the problem of decreasing the pressure for non-renewable natural resources by substituting them with renewable resources. Out of the social (and cultural) conditions as the most important can be regarded the syndrome of consumerism (megatrend) together with the changes of the value system.

Despite the dominant trend in the social and economic thought (as well as the political thought) that suggests increasing the pace on the modified industrial path of agriculture development, there appears an option of orientation to the

alternative agriculture in the form of sustainable agriculture or socially sustainable agriculture. We cannot deny the great advantages of industrial agriculture for consumers (the abundant supply of agricultural and food products) and the social advantages in the form of transferring the poorly used resources of agricultural workforce to more effective sectors, which gave rise to a huge increase of economic growth and development. However, at the same time we cannot deny the undoubted social disadvantages (loss of economic and cultural vitality by many villages) and environmental disadvantages (degradation of environment, reduction of non-renewable resources), as well as ambiguous effects for the society of farmers (deprivation). It was these negative phenomena that gave rise to the need of looking for an alternative method of producing agricultural and food products, that is sustainable agriculture or socially sustainable agriculture. The latter strongly stresses the social issues. The characteristics of industrial agriculture and socially sustainable agriculture has been included in another study[1], which exempts us from presenting it. Here we will focus on selected premises of the choice of the political option for the benefit of sustainable agriculture.

- First we will refer to the philosophical premises. There is a relative consensus regarding the fact that a huge growth of prosperity in the last half century has caused the limitation of capacities of ecosystems in the scope of performing significant environmental functions (such as e.g. provision of clean water, clean air, fishing, benefits of forests). However, the opinions are divided on the issue whether it is possible to reverse those disadvantageous phenomena without a significant reorientation of approach to the economic growth. Discussions in this field have been going on for a couple of decades and still have not brought unambiguous solutions. Some think that the scientific and technical progress eliminates the environmental barrier of the economic growth, for the mere reason of reducing the material consumption of useful products. At the same time others think that the economic growth cannot be unlimited, because it must encounter an environmental barrier, because the ecosystem (environment) is closed (limited), and the economic system constitutes a subsystem of ecosystem. This leads to thorem of impossibility[2]. In connection with this there are concepts of replacing the motif of profit (the private microeconomic criterion) by common goods[3], meeting the social criterion.

[1] See A. Woś, J. St. Zegar, *Rolnictwo społecznie zrównoważone*, IERiGŻ, Warsaw 2002.
[2] H. Daly, *Sustainable growth: an impossibility theorem*, [in:] Valuing the Earth: Economics, Ecology, Ethics. MIT Press, Cambridge M A 1993.
[3] The idea of common good has been perfectly presented in the study: M. Lutz, *Economics for the Common Good*, Routledge, London and New York 1999.

These concepts are put forward by economists-ecologists, however also among them there are views on the possibility of combining the profit-oriented economy with the natural environment protection[4]. Therefore the fundamental controversy comes down to rejecting the assumption of substitution infinity and lack of natural (environmental) limits for the economic growth, which is supposed to ensure an unlimited scientific and technical progress, and adopting the assumption of the economic system development within the limited ecosystem.

- Many symptoms indicate the collapse of the industrial path of agriculture development. The reasons of this are in the growing awareness of lost advantages in the form of public goods, deteriorating price relations, decreasing effectiveness of using the non-renewable resources, as well as in the consumer preferences (green consumerism). Most often in the discourse the negative effects of agricultural activity are raised. They consist mostly in: a) excessive pollution of surface and underground waters[5]; b) excessive pollution of soil and its physical, chemical and biological degradation[6]; c) pollution of atmosphere especially by emission of ammonia, methane and nitrogen oxides from fertilizers, which contributes to the greenhouse effect[7], d) destroying habitats and limiting biodiversity, including especially many species of birds that nest and feed on the arable lands; e) decreasing the natural resources, including especially the landscape[8], f) threatening the weelbeing of animals (which is taking place especially in industrial holdings: great pig fattening houses, broiler and layer farms), g) threatening the safe food both on

[4] More see K. Lux, *The failure of the profit motive*, Ecologically Economics, vol. 44, No 1/2003, p. 1-9.

[5] Caused by using artificial fertilizers, pesticides, excessive livestock density (excessive concentration of animal production), lubricants and fuel leaks, improper waste management (including animal droppings), infringing the water systems because of draining or irrigation (exhaustion of resources).

[6] The physical degradation of soil is caused by wind and water erosion, drying – desertification (steppization), crushing etc., the chemical degradation – by acidification, salinity, deposition of heavy metals, and biological degradation – by changes of microorganisms (including bacteria in soil) and changes in the content of humus in soil.

[7] Agriculture in EU-15 is responsible for approximately 1/10 of emission of greenhouse gases. This relates to nitrogen dioxide (N_2O) – mainly because of fertilization, methane (CH_4) – approx. 40% of the total emission falls for agriculture, mainly because of ruminants and CH_4 and N_2O from animal droppings contributes to the so called acid rains, which destroy forests and acidify waters. Agriculture participates in the creation of the phenomenon of the so called acid rain, because it emits ammonia NH_3, which by connecting with water of oxygen can change into nitric acid; agriculture is responsible for 85% of ammonia emission). On the other hand, methyl bromide used in agriculture contributes to destroying the ozone layer.

[8] By destroying ponds, springs, marshes, boggy lands, baulks, hedges, etc.

account of new not fully recognized effects of introducing GMO (genetically modified organisms) and diseases[9]. In the local scale the odours from big farms, feed mixing facilities and silages are also arduous.

The negative pressure exerted by agriculture on the environment is connected first of all with the model of industrial agriculture. And this is mainly thanks to a high intensification of production and the agrarian structure, and to be more precise, far reaching land concentration and production. This in particular relates to the animal production. Compensation of the effects of environment degradation requires big inputs incurred by taxpayers and consumers (e.g. for the purification of polluted waters, reversing the negative effects of exhausting underground waters for the needs of melioration, or restoring the quality of degraded soils). Decreasing this effect is favoured by the policy of countries consisting in imposing discipline on the industrial agriculture (environment norms) by some legal norms[10], which forces decreasing the environment degradation. In developed countries an aware and purposeful supporting of sustainable agriculture mainly by agricultural and environmental packets is becoming more and more common, apart from administrative and legal limitations imposed on industrial agriculture. This in particular relates to the European Union countries.

- Agriculture produces market goods, i.e. goods being the subject of market transactions, and goods not present in the market. The former goods receive a market price that enables economic entities – in a given case agricultural holdings – to establish an economic benefit (profit), which constitutes the basic economic motif of an economic activity. A different situation is with inherent external effects accompanying an agricultural activity.

[9] More than 40 diseases transmitted to people from animal droppings have been found. The remains of antibiotics (bacteria) are transmitted to people via animal droppings and meat (e.g. salmonella bacteria). Also the existence of bacteria resistant to antibiotics is becoming an increasingly growing problem.

[10] For example in Poland poultry holdings with more than 40 thousand standings and pig holdings with more than 2000 thousand standings (with weight > 30 kg) or 750 standings for sows should prepare a fertilization plan in compliance with the rules of good agricultural practice (approved by the chemical and agricultural station) and manage at least 70% of liquid manure and slurry on their grasslands. The liquid manure and slurry must be stored in tight and closed containers. The use of liquid fertilizers was banned from use on soils flooded with water, covered with snow and frozen up to 30 cm in depth and on lands without plant cover with the inclination of $>10^{o}$ and during the vegetation of plants intended for direct consumption. Other limitations have also been introduced. The fertilizer management should be based on the fertilization plan, balance of fertilizer compounds and documentation cards of individual fields. These farms constitute a threat for environment, first of all because of large quantities of droppings concentrated on a small area, not to mention the odours; they also infringe the traditional system of rural management.

These effects can be negative (public anti-goods), which happen when an agricultural activity causes specific damages in the people's environment. They can also be positive (public goods), which happens when an agricultural activity is accompanied by the creation of goods beneficial for people, which they can use free of charge. These goods are not the subject of market transactions, and therefore do not have a defined price, but this definitely does not mean that they are worthless or meaningless for the prosperity of people. Valuing the environment services and public goods for the quality of life, further development and even the possibilities of existence of future generations is growing fast. The necessity to limit the pressure on the environment exerted by industrial agriculture because of using non-renewable natural resources, degradation of soil and emission of pollution – on the one hand, on the other – providing public goods (environmental, such as landscape, social and cultural goods) and renewable resources – put agriculture in a completely new light in the structure of social judgement. One may expect an increase of the social evaluation of environment services and public goods created by agriculture, as well as a growing role of agriculture in the production of renewable resources for the food and non-food needs. The valuation of environmental services of ecosystems (agroecosystems) should come from functions performed by them. These functions have not been fully recognized yet, not to mention their evaluation. These functions are grouped by some into four classes as regulating, settlement, production and informative functions. The first ones regulate the processes taking place in ecosystems, so that they maintain the ability of self-regeneration (continuation of functioning) and maintaining parameters of ecosystems in a relatively narrow strip of conditions of people's life (e.g. cleanliness of air or water). The second ones consist in creating habitats for plants and animals, i.e. creating conditions for maintaining biodiversity. The basic aim of the third function is the production of biomass in different forms and for different use (food, non-food materials, genetic resources). Finally, the informative functions consist in delivering esthetic, cultural, artistic, spiritual, historical and scientific information. In this judgement we increasingly notice the necessity to coexist directly with other inhabitants of the ecosystem, which also causes the care for the wellbeing of farm animals. Measuring the values of environmental services is very important and can change the whole economic calculus (social and economic one), which is the basis of the decision. It turns out that the value of those services can exceed the value of services valued by the market. This is proved by calculations performed by numerous experts[11].

[11] R. Constanza et al., *The value of the world's ekosystem services and natural capital*, Natura, vol 387, 15 May 1997, p. 253-260.

This is a very complicated issue, mainly because of omission of environmental services by the market (and not only), because the market is directed by the private criterion, taking into consideration the short-term interest. Meanwhile while valuing of environmental services we have to be directed by the social interest in the long-term, at the same time treating the maintaining of effectiveness of ecosystems as an important social aim. The full value of environmental services covers at least three components, namely: the economic value (based on the effectiveness), the ecological value (based on the durability) and the social and cultural value (based on non-material elements of the quality of life). Another approach stresses the usage value and non-usage value of goods and services (functions) of the ecosystem. The former includes the consumption value (production of biomass, provision of water) and non-consumption value (aesthetic values, maintaining habitats, protection against erosion or flood), the latter includes for example maintaining the biodiversity, protection of the cultural heritage[12]. The standard measure of the effectiveness and efficiency relate only to market goods, and omit the environmental effects (external effects), which deforms the calculus of the agricultural production effectiveness (the social calculus)[13]. New challenges connected with the valuation of non-market services, the rights of future generations.

- In the second half of the 20th century in the agriculture of developed countries there was a great progress, including the organization of agricultural holdings (concentration of lands, production and specialization), technologies, new species of plants and animals, industrial capital goods. This undoubtedly contributed to a significant increase of the efficiency (productiveness) in agriculture. For example in the American agriculture the general productiveness (efficiency) of production factors increased annually on average by 1.9% in the years 1960-1990[14].

The basis of the economic growth was the innovations that in case of agriculture enable to overcome the physical and biological limitations (natural limitations). Such assumption formed the basis of the general tenor of the

[12] See Valuing Ekosystem Services. Toward Better Environmental Decision-Making. Report in Brief, The National Academy of Sciences, Washington D.C., Nov. 2004.

[13] For example, according to the research the actual growth of efficiency (productivity) of American agriculture is by 12-18% lower than this is shown by the conventional measurements, if we take into account the environment pollution because of excess of nitrogen (V.E. Ball, C.A.K. Lovell, R. Nehring, A. Somwaru, *Incorporating undesirable outputs into model of production: an application to US agriculture*, Cashiers d'Economie et Socjologie Rurales no 31/1994, p. 60-74).

[14] V.E. Ball, G.W. Horton, *Agricultural Productivity: Measurement and Sources of Growth,* Kluger Academic Publisher, Boston 2002.

discourse in science, also in the scope of the economic and agricultural science. A relatively fast growth of agriculture productiveness, together with eliminating less efficient agricultural holdings, favoured reducing the income disparity between the agricultural population and non-agricultural population. The dissemination of multi-professionalism in agricultural families, i.e. undertaking work outside an agricultural holding, also favoured reducing the income differences of agricultural families[15].

An essential meaning in the past had the biological progress, however it gave space in the valuation (assessment) to technical and organizational progress. For some time we have been observing taking the lead by the biological progress, which is becoming one of the most essential drive forces of the agriculture development, and at the same time, opposed to methods of agricultural intensification, it has an ecological character[16]. At present this progress is determined by the analyses in the scope of biotechnology and genetic engineering[17]. The assessment of the progress created by such research gives rise to serious discussions. Regardless of the indirect influence of achievements of the biological progress – GMO – on the safety of food and environment (ecosystems), the economic effects are important, including in particular the division of economic benefits. The previous experiences show that these benefits are reached by corporations, while they do not affect agriculture, but at best it affects some farmers[18]. Apart from the biological progress, the technological progress in communication exerts an essential influence on the environment and in general on the rural society, and it creates a chance to overcome the geographical and information isolation. Three elements are particularly essential here: the human resources, the technical infrastructure and proper financing. A special meaning is given to the so called social capital, including institutions, norms, shaping of relations, etc. In this kind of progress

[15] B.L. Gardner, American Agriculture in the Twentieth Century: How It Flourished and What It Cost, Cambridge, MA: Harvard University Press, 2002.

[16] And this is because – according to H. Runowski – „This is connected with improving the genetic features of plants and animals, making them more and more efficient from the point of view of using the forces of nature and industrial capital goods and of better quality from the point of view of requirements of a man" (H. Runowski, *Postęp biologiczny w rolnictwie*, Wyd. SGGW, Warsaw 1997, p. 24).

[17] Biotechnology = integrated usage of biochemical, microbiological and technical methods of using microorganisms and spores of tissues for production purposes. Genetic engineering = transplantation of genes to cells in order to shape such genetic code of a plant that is best from the production point of view (e.g. triticale).

[18] For example in the US the research has shown that genetically modified soy did not have an influence on the incomes of farmers (however the amount of their free time has increased). See J. Fernandez-Cornejo, W.D. McBride, *The Adoption of Bioengineered Crops*, USDA ERS, Agr. Econ., Rep. 810, May 2002.

great possibilities are created by the use of the Internet which is becoming incredibly popular, because it facilitates the selforganization of farmers, access to market information, direct contact of farmers with consumers and the development of new kinds of activity.

The previous form of progress is questioned, which in the industrial agriculture consisted mainly in maximizing the usage of non-renewable resources (chemization, mechanization) in order to multiply the private economic benefits of the decreasing number of farmers (concentration, specialization), without respect for the environment and the rights of others. The example of the famous „Green revolution" is nothing else than growing species that for the maximization of production (and economic benefit) made it possible to use a greater amount of chemical agents and at the same time required more limited resources of sweet water. Also the concepts of precise agriculture promoted at present – that is undoubtedly more environment-friendly – fit in the model of industrial agriculture, prolonging its agony. The new form of progress requires replacing the industrial intensification by the agrobiologic intensification, using the natural laws and the really unlimited resources: solar energy and knowledge that constitutes a resource not only renewable, but also positively reproduced.

- The improvement of the economic level of societies increases the interest in safe food, which is expressed in the phenomenon of "green consumerism". So far this phenomenon has a niche character and remains far in the shadow of the megatrend known as consumerism. A mass consumer demands cheaper products, which can be provided by the model of industrial agriculture. To consume more, and to be more precise, to buy more, is the main task of the arduous and ethically doubtful advertising – still at the consumer's cost. This bears the phenomenon of consumerism, which separates the purchases of goods from real needs, forces to put an increasingly greater effort in order to gain funds for increased purchases (demand) and … the spiral is wound up.
- Industrial agriculture provides benefits (survival) for the decreasing group of agricultural families more and more separating them from the rural society – separating the vitality of holdings from the vitality of villages (the economic and social vitality), as well as limiting the possibilities of alternative activities of the rural society by the negative influence on the natural environment and rural landscape. Sustainable agriculture for obvious reasons favours the vitality of villages, creating conditions for its multi-functional development. It also enables to engage in the agricultural activity a greater number of people, which is important in the conditions of unemployment and

a simultaneous lack of alternative jobs. However this agriculture requires far more knowledge than industrial agriculture.

- Finally the political premise resulting from the awareness of inefficiency of market in the scope of the level (intensity) of using the environment and creating public goods, which induces to undertake political actions. First of all we need a proper development strategy of agriculture (it moves along a chord, not an curve). Policy stands in face of the option of increasing the pace, which is the main recommendation of the contemporary liberal thought, or the option of fundamental changing the aims and the criteria of development. The key solutions in this scope can come down to: a) Eliminating defects of the global market, which is directed by the criterion of private (microeconomic) economic benefit, omitting the local environmental effects; b) Proper remuneration for creating public goods and rendering environmental services, and charging fees for using the environment according to the PPP principle (Polluter Pay Principle); c) Harmonizing (balancing) the interests of all participants of the agriculture development progress: various groups of farmers, consumers, extra-agricultural links of the food chain and „silent" participants (the natural environment, farm animals, future generations); d) Supporting agricultural and rural institutions and building the social capital.

4. Levels of research

Research of socially sustainable agriculture should be conducted on two levels, that is the macroeconomic and the microeconomic level. This differentiation seems purposeful, because the measures (indicators) of sustainable development for those levels are not equal, the function of aim of an agricultural holding (private microeconomic function) differs essentially from the function of the aim at the macroeconomic level (social function), the assessments of environment valuation (which most of all has a local character) and criteria of social balance are distributed differently. This is the expression of a well-known saying that forest is more than individual trees. The macroeconomic level relates to the whole agricultural sector (Section). At this level the following issues will be the subject of the research:

1) the share of the agricultural sector in the land (surface) usage, in employment indexes, creating income, covering the national demand, trading with abroad;
2) degradation of the natural environment by agriculture;
3) limits created for sustainable agriculture by the triad of conditions: globalization – integration – macroeconomics;

4) the influence of the macroeconomic policy on agriculture in the aspect of sustainability;
5) political instruments in the scope of fulfilling sustainable agriculture.

At the microeconomic level the subject of research will be the scope of meeting by the groups of agricultural holdings of established threshold values of features and the production, economic and social characteristics of those holdings. The analysis will also be conducted in the spatial system (that can be regarded as the transitional level), namely at the level of voivodeships and certain separated areas with specific relations between the economic, environmental and social features. It is among others about the areas covered by the NATURA 2000 programme, areas with unbeneficial management conditions, areas with the protected environment.

5. Empirical (factographic) bases

Recognition of the existing empirical bases shows that the analysis at the microeconomic level can be conducted on the basis of the IERiGŻ-PIB data (FADN – Farm Accountancy Data Network) and the Central Statistical Office (GUS) data (the national census of 2002 and the structural research of 2005 and 2007). In relation to the FADN data it is necessary to deepen the recognition in the scope of fertilization and feeds by using data conducted for the needs of costs calculation and assessment of external experts (fertilization balance, feed balance). In relation to GUS databases we assumed selecting the panel set of holdings from the National Agricultural Census of 2002 and the structural research of 2005 and 2007. Moreover, as a supplementation, the data of large-surface holdings and WAW (IERiGŻ-PIB) can be used, as well as other GUS data (other agricultural analyses, analyses of budgets of households). The database of the Agency of Agriculture Restructuring and Modernization will be used to establish the groups of holdings supported by the transfers of funds as part of the agricultural and environmental programme.

6. Method of research

We assumed that three research methods will be mainly used, namely:
1) macroeconomic calculi: the satellite calculus for the agricultural sector (EAA) and the environmental and economic calculus for the agricultural sector (EEAA);
2) tabular analysis (empirical data of FADN and GUS):
3) descriptive and tabular analysis of the agricultural and environmental programme and the so called organic agricultural holdings;

4) analysis of regression and correlation and the functional analysis, as well as the system analysis (scenarios).

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FEATURES OF SUSTAINABLE AGRICULTURE

1. Introduction

The general notion of sustainable development relates to various areas of human activity, including agriculture, which is very sensitive in terms of connections with the natural environment.

According to Fotyma (2000) sustainable development of agriculture takes a special place in the general concept of sustainable development of society. Agriculture is generally considered as one of the main disposers of the natural environment. At the same time in the economical and agricultural literature a view is stressed that contemporarily one of the priorities is the sustainable development of rural areas. Such approach is connected with perceiving various agricultural and extra-agricultural functions that are realized in rural areas.

The production (feeding) function of rural areas is connected with the agricultural activity. Sustainable agriculture is treated as an alternative for intensive industrial agriculture, in which an essential meaning have big farm inputs of industrial origin (Kuś 2005).

Interest in sustainable agriculture in economically developed countries is a consequence of the critical assessment of intensive agriculture, characterized by a high specialization, mechanization and big concentration of production (Kuś 2005).

The notion of sustainable agriculture is at present universally used, but at the same time it is understood in a number of different ways. Runowski (2000) claims that this notion can include different contents, depending on the field of interest (profession) of the defining person.

In the view of economists (Woś, Zegar 2002) „the essence of socially sustainable agriculture is such acting of entities that does not threat the long-term interests of the society".

On the other hand Michna (2000) thinks that „without social and economic balance it is not possible to achieve the ecological balance in the long term".

From a more practical perspective „sustainable agriculture simultaneously and harmoniously fulfils the production, economic, ecological and social goals". In various definitions sometimes the significance of one of the goal group is

stressed stronger than the others. An example is the nature-oriented definition, according to which „sustainable agriculture is such organization of production that does not cause changes in the natural environment or creates small changes directed at elimination of environment degradation (e.g. erosion)".

Farmers believe that „the general notion of sustainable agriculture must be related to the basic entity in agriculture, i.e. an agricultural holding" (Fotyma 2000). According to this assumption „sustainable agriculture is a systematic development of a holding and an increase of the production level, enabling the growth of prosperity, modernization of the technical equipment, increase of the efficiency and safety of work, the social safety" (Grabiński, Mazurek 2000).

Definitions of sustainable agriculture often raise the problem of using soil resources. According to Smagacz (2000) „agriculture defined as sustainable or durable is directed at such usage of soil resources that does not damage their natural sources, but enables satisfying the basic needs of subsequent generations of producers and consumers".

Ziętara (2000) claims that the approach to balance in agricultural holdings and enterprises is changing. „The organic theory of an agricultural holding assumed the internal balance, not only between the production factors, but also in the production process. This was reflected in the sustainability of the most important balances with an assumption that a holding should be internally sustainable, mainly on the basis of own resources. In the market economy in order to even up the most important balances, a participation of external resources is allowed in a holding".

The contemporary views indicate the necessity for a system approach to the organization of an agricultural holding. According to this approach an agricultural holding constitutes an element (subsystem) of the system of the natural and economic surrounding. Some claim that the surrounding of an agricultural holding is the rural areas.

The presented deliberations show that sustainable agriculture is characterized by a defined specifics.

So far in the literature the problem of the features of sustainable agriculture has been investigated fragmentally, and often also subjectively. Many authors have been referring to the results of analyses conducted in the countries of Western Europe, that is in conditions that do not reflect the realities of the Polish agriculture.

The aim of the study is to present the features of sustainable agriculture in the light of analyses conducted by the Institute of Soil Science and Plant Cultivation – National Research Institute in Puławy.

IUNG specializes in environmental and technologic (agrotechnical) analyses. The scope and subject of those analyses are defined by the tasks of the statute activity programme, relating to the sustainable development of plant production and protection of the agricultural space in Poland. These analyses assumed the necessity to conduct the assessment of the agriculture sustainability at the global, international, national, regional levels, or in individual holdings (or their groups) and even fields. For each of those levels it is essential to develop research methods and choose proper indexes (Kuś, Krasowicz, 2001). The used methodologies and assessment indexes are derivatives of the features of sustainable agriculture, reflecting different aim groups and different aspects of sustainability.

In the light of the IUNG analyses the features of sustainable agriculture should be identified and investigated at the country (region) level and and the level of an agricultural holding. In order to identify those features, the results of the previous environmental and agrotechnical IUNG analyses were used, as well as the information included in various kinds of expert opinions and reports, and the views presented in economical and agricultural literature.

2. Features of sustainable agriculture at the country level

The main features characterizing sustainable agriculture at the country level are:

1) rational usage of the agricultural production space and keeping the production potential of soils,
2) providing the (net) food self-sufficiency of the country,
3) production of safe food,
4) production of raw materials with desired, expected by consumers and industry quality parameters,
5) limiting or eliminating threats for the natural environment and care to keep the biodiversity,
6) achieving incomes in agriculture that guarantee a remuneration of work comparable with other sectors of economy and provision of funds for modernization and development.

The mentioned features are a consequence of the production and economic analysis of agriculture in the scale of the country and in regions against the background of natural, economic and organizational conditions. A high share of light soils, more than 30%, characterized by a small water capacity that limits the choice of plants and their yield, big areas of highly sour soils and soils susceptible to erosion, as well as negligence in the scope of agrotechnics determine the current low level of using the agricultural potential

of the production environment in Poland (Terelak et al., 2000). The agrochemical research conducted under the technical supervision of IUNG showed that approximately 60% of Polish soils have a very acid and acid reaction, and soils with a very low and low abundance of phosphor and potassium constitute 40-50%. Additionally these indexes are strongly diversified regionally and between groups of holdings.

In Poland approximately 3 tonnes of corn grain are received from 1 ha, which indicates a relatively poor usage of the potential of the agricultural environment. At the same time the characteristic feature of the Polish agriculture are significant differences of harvests of corn and other agricultural produce year by year. A big changeability of harvests is one of the reasons of import fluctuations, it also determines the level of economy sustainability.

According to Michna (1997) Poland in the foreseeable future will not be able to give up the policy of the (net) food self-sufficiency of the country. Balance between the import and export of food must be shaped taking into consideration the possibility of the rational usage of the agricultural production environment. The superior principles of the rationalization of the agricultural production environment usage should be: maintaining the (net) food self-sufficiency of the country and providing the food consumption model similar to western countries, as well as providing safe food for the society.

The simulations conducted at IUNG show that after excluding the weakest arable lands and 30-50% of weak soils from the agricultural usage, with simultaneous raising of the agrotechnics and agricultural culture level on the remaining soils and decreasing the surface of idle lands on good and average soils, the net food self-sufficiency of the country can be achieved (Kuś, Krasowicz, 2004).

Maintaining the production potential of Polish soils at the level guaranteeing the (net) food self-sufficiency of the country moreover requires the following actions:

- maintaining the optimal reaction of soils and their abundance in nutrients, which is an important feature of balance in macroscale,
- transforming part of arable lands into permanent grasslands and afforestation of the weakest lands,
- rational crop structure, limiting the unfavourable results of an increased share of corn in the crop structure,
- supporting various management systems (apart from the conventional, traditional system also the integrated and ecological system),
- maintaining fallows and idle lands in the state of the so called production readiness,
- regular control of the agrochemical state of soils.

At the same time an essential matter is to adjust the intensity and level of production to the national needs and export possibilities. Regarded as one of the main priorities in the scientific research and agricultural practice, the production of safe food requires using effective and safe production technologies. Technologies must be effective, that means they should provide the minimum (rational, optimum) farm output, as well as the cost per a unit of product.

The priority of the technology quality and safety relates to all links of the food chain, including also the technology of the plant raw materials production (Michna 2000). The safety of technology consists, generally speaking, in eliminating the negative influence of agrotechnic treatments on soil, underground water and cultivated plants, as well as receiving products with defined quality and performance parameters. Such products favour maintaining the health of people and the wellbeing of farm animals. They are also important from the perspective of international food trading. They also enable receiving relatively higher prices, and therefore also higher incomes of farmers. The care for people's health induces also to give up using synthetic antibacterial in the animal production synthetic, antibacterial feed additives (GPA). An alternative solution, in which the IUNG is interested, could be using natural plant substances, i.e. compounds belonging to the so called products of secondary plant metabolism (volatile oils, saponins, tannins, phenolic compounds, alkaloids, flavonoids) or plant extracts having a beneficial effect on the wellbeing of animals (Oleszek 2000).

The dependencies between the food quality, the nutrition method and the health of people caused a significant growth of the quality requirements in relation to plant products intended for direct consumption, for feed and as raw materials for industry. The quality of plant products can be shaped by defined agrotechnic treatments (fertilization, plant protection). However, this requires big specialist knowledge, and often also the help of advisers. A factor favouring the production of safe food and limiting threats for the natural environment generated by agriculture is also observing the rules of conduct described in the Code of Good Agricultural Practice.

Generally it can be stated that the basic method of receiving safe food is the widest possible usage of the integrated management system. This system, through individual elements of technology, favours the realization of the concept of sustainable agriculture (Kuś 2005). However it requires financial and technical support, as well as knowledge-based management. An important feature of sustainable agriculture, considered at the level of the country, is striving to limit or eliminate the threats for the natural environment. The IUNG analyses representative for the country (Terelak et al., 2000) show that only

0.4% of Polish soils should be excluded from the production of food because of being polluted by heavy metals. However, this does not mean that the problem can be ignored, especially that a range of threats can have a local character. So, in order to realize the idea of sustainable agriculture in the scale of the country, we have to recognize the current and future sources of threats and undertake preventative actions or actions providing reclamation of polluted lands as a result of agricultural, industrial, community activity, etc.

According to Faber (2001), agriculture should also be keenly interested in the protection of biodiversity, not only because it significantly influences it, but especially because it is one of the main beneficiaries of it. „The future of agriculture that is more nature- and environment-friendly, but at the same time is durable and effectively covers the needs for healthy food, can depend more on the biodiversity than it could seem so far. The easiest justification of this thesis is in Faber's opinion (2001) the fact that „we do not produce food, it is the species of plants, animals and microorganisms that do it for us. Their diversity in connection with good agricultural practices should create agrosystems that will be better harmonized components of wider and mutually co-dependent ecosystems and landscapes".

A condition favouring the realization of the concept of sustainable development of agriculture in the country (region) is receiving in agriculture, as the sector of economy, incomes enabling a comparable with other sectors of national economy remuneration of work and provision of funds for modernization and development. Such state favours the implementation of new, environment-friendly systems and production technologies. It also increases the interest of farmers in proecological actions, both in the production area, and the internal infrastructure of holdings.

The IUNG research show that the basic methods to improve the income situation of agriculture should be the optimization of usage of the basic production factors, among others by regionalization and cost reduction. These two methods constitute important premises for agrotechnical and zootechnical analyses. They are also important indicators of the advisory activity realized with the support of science, but requiring also support from the national authorities.

The features of sustainable agriculture at the country level are a peculiar synthesis, or rather a resultant of features of individual holdings and a reflection of their specifics and diversity.

3. Features of sustainable agriculture at the level of an agricultural holding

In literature much space is devoted to the problem of the choice of indexes for the assessment of the sustainability level of an agricultural holding. According to Faber (2001a), the choice of indexes depends on the accessibility of data and the level of their aggregation. Runowski (2000) stresses the necessity of looking for indexes enabling a synthetic assessment of a holding, its internal organization and connections with the surrounding, that is the rural areas. In the research we should moreover take into consideration the connections and feedbacks between plant and animal production and between a production holding and a household. There is no doubt that the indexes used for the assessment should reflect the features of sustainable agriculture at the level of a holding and its relations with the surrounding.

The IUNG research shows that the main features of sustainable agriculture at the level of an agricultural holding are:

1) providing a durable fertility of soil,
2) adjusting the branches and directions of production, plant species and animal breeds to the natural, economic and organizational conditions,
3) sustainable balance of the organic substance,
4) sustainable balance of food (fertilizing) elements,
5) high soil cover by plants index,
6) integrated plant protection,
7) observing the rules of correct agrotechnics and zootechnics,
8) care to maintain the biodiversity,
9) livestock density adjusted to the absorption potential of the ecosystem,
10) rational equipping holdings in the scope of technical infrastructure,
11) observing the rules of the Code of Good Agricultural Practice,
12) rational organization of work and a skilful holding management,
13) perceiving a holding in its relations with the surrounding (rural areas),
14) earning incomes ensuring comparable with work outside agriculture remuneration for work and funds for development (investments).

The mentioned features often characterize the state that a holding realizing the concept of sustainable agriculture in microscale should strive to achieve. Achieving the state described by each of the features of sustainable agriculture requires various actions in an agricultural holding. These actions are confirmed by the results of scientific research and have a practical dimension.

In order to ensure a permanent fertility of soil the following actions are undertaken:

– using multilevel crop rotations with the use of papilionaceous plants and aftercrops for green manure,
– using organic fertilization,
– using after-harvest residues, straw ploughing, strengthening the biologic activity of soil,
– limiting the number of mechanic cultivation treatments in order to reduce soil packing.

An ideal situation would be using the Norfolk crop rotation (50% of corn, 25% of root crops, 25% of fodder plants) guaranteeing the corn cultivation after good forecrops, i.e. after non-corn plants. At present in Poland an average share of corn in the structure of crops exceeds 70%, and in many administration units and holdings it is even higher. A particularly big concentration of technologically similar plants, harvested with the use of a combine-harvester (corns, rape) is present in the northern and western parts of Poland. **Is it a barrier limiting achieving the aims of sustainable agriculture in holdings?**

The research conducted at IUNG shows that a crop rotation consisting of only corn plants were characterized by low direct production costs and, despite relatively lower yields, created a possibility to achieve a direct surplus at the level close to the classic Norfolk crop rotation. Crop rotations consisting of corn only (the so called multi-species corn monocultures) should be assessed positively on condition of a beneficial, adjusted to the soil quality, choice of their species, in conditions of achieving relatively high crops from one hectare and using careful agrotechnics, as well as a moderately intensive production.

The proper choice of the production direction, the choice of animal species and breeds reflecting the natural, economic and organizational conditions, that is a proper regionalization (location) of production favour the improvement of its effectiveness, and at the same time the realization of production and economic aims of sustainable agriculture.

A sustainable balance of the organic substance in a holding is an important ecological index. Reaching this state requires using (cultivating), apart from plants degrading soil on account of the content of humus, of also plants enriching soil with organic substance (Maćkowiak 1997). Organic fertilizers also have an essential meaning, because they enrich soil on account of the content of humus, proportionally to the used portion of fertilizer.

The balance of food elements (fertilizers N, P, K) characterizes the effect of an agricultural holding on the natural environment (surrounding). High positive balances prove the possibility of relocating unused elements (mainly N

and P) to underground and open waters and in case of nitrogen – escaping to the atmosphere. The shortage (high negative balance) can on the other hand indicate the danger of degradation of the production potential of soils (Kopiński 2002).

In order to achieve a sustainable balance of food (fertilizing) elements, one should:

- take into consideration all used forms and types of organic and mineral fertilization,
- balance doses of NPK entered in mineral and organic fertilizers with the collection of elements with yields,
- take into consideration the requirements of the habitat and the agrochemical state (abundance) of soils,
- use the IUNG computer systems of fertilization consultancy (NAW-3, NAWSALD, MACROBIL).

From the perspective of the effect of an agricultural holding on the environment, an important meaning has the soil cover by plants in the winter (Kuś, Krasowicz 2001).

The soil cover by plants in the winter index is expressed by the relation of the area of the cultivation of winter crops, perennials and intercrops to the total area of arable lands. Higher values of this index indicate a smaller threat with washing out of nitrates and a better protection of soils against erosion.

An integrated protection of plants in a holding is also connected with limiting some unfavourable effects of agriculture on the environment. It also influences the level of realization of the economic aims, shaping the amount of the direct surplus from one hectare of individual crops (Nawrot 2004).

This feature of sustainable agriculture is connected with the following actions at the level of a holding:

- using proper sequence of plants,
- choice for the cultivation of species and varieties of plants resistant to diseases and pests,
- observing optimum agrotechnic periods,
- using the methods of biologic and mechanic plant protection with a simultaneous limiting of the chemical protection and using it after exceeding the economic thresholds of pathogens harmfulness.

Another feature of sustainable agriculture at the level of a holding – observing the rules of proper agrotechnics and zootechnics is connected with the necessity of using technologic consultancy, constant increasing of the level of expert knowledge and using self-regulating mechanisms of ecosystems and the so called non-input production factors (quality, care, promptness).

The care to maintain the biodiversity should accompany a farmer's actions, but it encounters a range of limitations in a form of collision of different aims. According to Faber (2001), the concept of multi-functional development of rural areas will be able to combine the conflicting needs of food production and environment protection – maintaining biodiversity.

Adjusting the livestock density to the absorption potential of the ecosystem requires taking into consideration the relations and feedbacks between plant and animal production, which is the essence of the organic approach. It is also advisable to prepare a balance of organic fertilizers and a balance of feeds, enabling to establish the optimum amount of livestock in a holding.

Rational equipping a holding in the scope of technical infrastructure requires:

- recognizing and eliminating negligences,
- using the existing infrastructure of rural areas (including a holding to the existing networks),
- modernization and extension of the technical infrastructure inside a holding (in this scope there are significant negligences).

An agricultural holding realizing the concept of sustainable agriculture should observe the rules of the Code of Good Agricultural Practice. This Code, written at IUNG in the cooperation with other scientific institutes dealing with agriculture, constitutes a compendium of knowledge, indicating the essential actions and their legal grounds (Duer, Fotyma, Madej 2004). Observing the rules included in this document favours shaping the ecological awareness and a management based on knowledge, as well as a systemic (holistic) approach to an agricultural holding.

In order too achieve the state of balance an agricultural holding should be characterized with rational organization of work and be skilfully managed.

Meeting these requirements indicates a necessity to undertake the following actions:

- recognizing the existing resources of production factors,
- keeping the management accounting and an economic calculus,
- optimization of the usage of own resources,
- knowledge and usage of the existing advantages of a holding (e.g. its location).

This feature is connected with a necessity of perceiving a holding in its relations with the surrounding (rural areas). A holding should strive to use the connections favouring the development and limit the negative effects.

Similarly to the country level, the development sustainability cannot be achieved without achieving a proper level of agricultural income, ensuring a comparable with other sectors of economy remuneration of work and funds for modernization and development of agriculture. Realization of this feature requires:

- development of „economic thinking" and effective marketing,
- reducing the production costs (increasing competitiveness),
- searching for alternative sources of income, e.g. the production of biomass for energetic purposes, agrotourism.

Some of the presented features of sustainable agriculture at the level of a holding, such as the sustainability level of balances of fertilizing elements or the balance of organic substance can be viewed also at the level of a country or regions (Kukuła 2005). Then they have an informative meaning, indicating the existence of some threats for the production potential of agriculture in macroscale, and at the same time for the food self-sufficiency of the country.

Table 1. Selected parameters to define the level of aims realization of sustainable management (acc. to Vereijken 1997, Fotyma and Kuś 2001)

Parameter	Assessed aims	Description of establishing the parameter and its value
Ecological structure index	landscape, biodiversity	The share of lands not used agriculturally (baulks, woodlots, ponds, etc.). Desired share over 5%
Pesticide index	environment protection, quality of products	Joint index of the number of pesticide treatments in crop rotation and doses of pesticides in relation to recommendations in conventional agriculture. Desired value 50%
Soil cover by plants index	environment protection, landscape	Percentage of croplands remaining permanently under plant cover. Desired share 80%
Nitrate index	environment protection	Content of nitrates in the soil profile after harvesting plants. Desired value up to 60 kg $N\text{-}NO_3$/ha
Balance of phosphor and potassium	environment protection	Balance of P and K, depending on the abundance of soil in these elements. With the average abundance balance = 0
Gross agricultural income	level of income and employment	Counted in the adopted way. Desired values near the parity income

In the research on the level of production sustainability in holdings held at IUNG the following indexes were used most often: gross agricultural income, balance of mineral elements, balance of the organic substance, effectiveness of

the energy usage, soil cover by plants index and the number of performed plant protection treatments. These indexes were considered a synthetic reflection of the internal balance of a holding and its realization with the surrounding. Fotyma (2000) claims that each of the aims of sustainable agriculture requires parameterization, that is defining the indexes of the level of its realization. It is a complicated problem, because of the surd of some aims and the internal complexity. In practice for the assessment of the realization level of each of the mentioned aims we need a large number of parameters, and sometimes one parameter is used for the assessment of more than one aim (table 1). It should be stressed that the choice of indexes depended on the type of holdings taken into account in analyses and on the availability and level of information aggregation.

4. IUNG analyses of the assessment of the level of production sustainability in agricultural holdings

In the years 2000-2004 IUNG conducted analyses of the assessment of the level of production sustainability in agricultural holdings. For those analyses assumptions were made that an agricultural holding constitutes a limited whole, which means treating it in a systemic way. The basic source of data for the analysis was the data collected in family holdings cooperating with IUNG. Also the published data was also used regarding holdings conducting agricultural accounting under the technical supervision of the Institute of Agricultural and Food Economics (IERiGŻ). The scheme of the assessment was presented in table 2.

Table 2. Scheme of assessment of the holdings sustainability level in IUNG research

Item	Indexes used for the assessment of the sustainability level	Factors diversifying the sustainability level
1.	The balance of N, P, K	area of a holding, area groups in ha of croplands (UR)
2.	Balance of the soil organic substance in tonnes of dry mass for ha of arable lands (GO)	soil valuation index, quality of soils (natural conditions)
3.	Soil cover by plants index in per cent	production direction (specialization) of a holding: milk production, pigs fattening, commodity plant production, multi-directional holding
4.	Net agricultural income in Polish złoty per holding and per 1 ha UR	
5.	Relation of net agricultural income per full-time equivalent to the average annual remuneration in non-agricultural sectors of national economy	
6.	Number of persons that can achieve remuneration for work in a holding comparable with non-agricultural sectors	

Source: Own research on the basis of holdings conducting agricultural accounting IERiGŻ-PIB and holdings cooperating with IUNG.

This analysis has shown that natural and organizational conditions limit the possibilities of realizing the sustainable development of holdings (Kuś, Krasowicz 2001). It was found that only holdings with the surface area of over 50 ha achieved agricultural income at the level enabling allotting financial surpluses for the development. However, on the other hand this group of holdings conducted very simplified production, specializing in the plant production, among which corn and rape were dominant. Simplifications in the structure of crops were compensated by a bigger usage of industrial means of production, and as a consequence the balance of fertilizer elements was unfavourable. However keeping the positive balance of soil organic substance was impossible thanks to ploughing significant amounts of straw (from 40% of surfaces of corn cultivation).

In smaller holdings the level of production sustainability in terms of ecology (sustainable balance of fertilizer elements and soil organic substance) was higher. However, the achieved net agricultural income in a holding did not provide remuneration of work at the level comparable with extra-agricultural sectors of economy, even per one person.

With the increase of the soil valuation index, the parameters of economic assessment of holdings were improved, but even a holding with a surface area of 23 ha on good soils did not ensure achieving agricultural income at the level guaranteeing a comparable with extra-agricultural sectors remuneration of work and allotting part of funds for development. In holdings with weaker soils the commodity animal production was clearly dominant. With the livestock density of about 0.6 SD/ha of croplands, the assessed ecological indexes (balances of fertilizer elements, balance of the soil organic substance) were shaped more beneficially than on good soils, where the plant production was dominant conducted in simplified crop rotations. However the net agricultural income was very low.

The research enabled to formulate conclusions with a general character, as well as specify some features of sustainable agriculture.

The possibilities of sustainable development of agricultural holdings are determined by the natural, economic and organizational conditions. The natural and organizational conditions first of all determine the intensity of plant and animal production organization, constituting a derivative of the diversity of the crops and livestock density structure. The economic conditions of agricultural production, resulting from the existing price relations, determine the intensity of management, measured with the level of material inputs and costs per 1 hectare of croplands.

The possibilities of balancing the production taking into account the different groups of aims were also assessed depending on the direction of the production specialization (Krasowicz 2005).

Generally it was found that holdings specializing in the commodity milk production and multi-directional (mixed) holdings realized the aims of sustainable agriculture. It is relatively easiest to realize the concepts of sustainable development in holdings specializing in the milk cattle breeding. Holdings conducting pigs fattening did not realize the concept of sustainable agriculture on account of the ecological criteria, and holdings specializing in the plant production – on account of unbeneficial economic outcomes. These conclusions relate however to specific economic conditions that are constantly changing.

The discussed analyses (often fragmentary) were first of all aimed at checking the usefulness and verifying the adopted indexes (indicators). At the same time their analysis enabled to indicate features characteristic for sustainable agriculture from the perspective of an agricultural holding.

5. Summary

The presented features of sustainable agriculture at the level of the country and an agricultural holding result from the analysis of different aspects of sustainability. They were indicated on the basis of environmental and agrotechnical analyses by IUNG, respecting however the meaning and strength of influence of economic conditions. Some of the presented features have probably a subjective character, resulting from the assessment from the angle of the environmental and agrotechnical research.

Research of sustainable agriculture, assessed in terms of production, economic, social and ecological criteria, should have an interdisciplinary character. Moreover they should be conducted in a longer period. Some effects that can have effect on the balance in agriculture will be disclosed, or stabilized, after many years.

In the light of the IUNG research the idea of sustainable development of agriculture is not a simple return to the organic theory of an agricultural holding. This is proved by a wide range of features. The features of sustainable agriculture were specified taking into consideration an assumption that in order to achieve a full realization of all groups of aims of sustainable agriculture it is not enough a strive to provide balance inside a holding.

It is essential to strive for balance in the relation of an agricultural holding with the surrounding. Such methodical approach is one of the indicators of IUNG research that are continued. It constituted also one of the foundations for

the construction of the Code of Good Agricultural Practice, which is a collection of principles enabling achieving the state of sustainability and realization of all groups of aims.

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SUSTAINABILITY OF PRIVATE FARMS IN THE LIGHT OF SELECTED CRITERIA

1. Introduction

The sustainable development has been the basic political orientation since the adoption of the Agenda 21 at the Rio de Janeiro Conference held in 1992. The transformation of the social and economic development (civilization development) towards sustainable development became the necessity dictated by the concern for the environment and future generations. However not everybody shares this point of view. It loses its competition with economic realities driven by liberal orthodoxy and cultural mega-trends oriented towards the immediate economic benefits. This also refers to Poland, in spite of the fact that the sustainable development principle was introduced into the organic law – the Constitution of the Republic of Poland.

The concept (principle) of the sustainable development refers also to agriculture. It will not be exaggerated to say that it is even exceptionally important for agriculture. Several reasons are of significant importance in this field. First, agriculture is the main user of the basic natural resources: soil and physical space. Second, agriculture plays an important role in interactions between the civilization development and the environment. Third, so far agriculture was excluded from administrational and economic regulations on the use of the environment. It does not bear negative consequences of the agricultural production on the environment, however it neither receives profits for positive outcomes. Fourth, in principle agriculture is multifunctional: it produces food (so it meets the priority needs) as well as non-food products (substituting the non-renewable natural resources which are being run out). It also significantly contributes to the viability of the rural areas. Fulfillment of these functions by the agriculture is not proportionate – the proportion depends on the agriculture model defined by the predominant mass of farms. The problem is that achieving progress within one area may be contrary to achieving a certain realization level within another area. The agricultural production is always accompanied by both positive and negative consequences for the

environment. The advantage of one of them depends on which agricultural practices (technologies) are used. To date experiences show that successes within the production function often have a negative influence on its environmental function.

The increasing valuation of the non-production functions will allow for a new approach to the agriculture functions and therefore to the agricultural policy principles. This policy switches to new agricultural model. In particular it refers to diverging from support for the industrial agriculture towards support for sustainability. This divergence started together with the Mac Sharry reform and was intensified by the Agenda 2000 and the following reform of 2003. In the perspective of the upcoming budgetary period, i.e. after 2013, further and significant change towards sustainable agriculture is expected.

The sustainable agriculture model is *in statu nascendi*. The idea and principles of such agriculture are well known, the same as its certain formal and legal requirements. However, taking into account all sustainability principles is practically impossible due to both their quantity and local conditions (relationships) – which concern a particular farm, or sometimes even a particular field or animal. This creates serious statistical problems, which seem to be difficult to overcome. There are two possible approaches to define the sustainability criteria or rather to determine a group of farms, which are more balanced than the others. First approach is based on enumeration (specification) of features which favor the sustainability and establishment of marginal value. Second approach is based on determining features and their threshold values. Exceeding this value results in excluding a farm from the group of sustainable farms. Both in the first as in the second case, one can refer more to probability than to certainty. However, in the statistical mass the picture of sustainability will remain accurate.

The sustainability can be viewed from various perspectives: in reference to an individual farm or at local, sectoral, macroeconomic or even global level. The need to define the sustainability for these levels result from the hierarchical decision system in politics and from other objective dependencies. For each of these levels the core of the sustainability remains the same, however measures – indexes will differ.

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The aim of this study is to initially analyze the sustainability of the Polish individual farms. The factual material includes generalized data from the representative structural research performed by GUS in June 2005 on the sample of more than 200 thousand farms[1]. This characteristic concerns the quantity and value of selected farms which fulfill the adopted sustainability criteria. The farms which fulfill the environmental and production criteria, including the economic criterion are selected. Also specific groups of farms were separated: Norfolk farms, Non-inventory farms and Subsistence Farms. They are of specific importance for sustainability in agriculture. In principle, this analysis does not include the organic farms which are not numerous and has already been characterized[2]. It neither includes market farms, the environmental and production sustainability of which was analyzed on the basis of data from farms keeping the accounts under the FADN system[3].

The selection of criteria for estimation of sustainability was decided on the basis of accessible statistical data. However, they are not sufficient to fully estimate the sustainability neither of agriculture nor farms. The latter would require larger number of criteria. Therefore naming the highlighted group of farms as sustainable should be considered merely as a try to use public statistics data for estimation of sustainability of farms and individual agriculture. The presented groups of farms provide only an approximate picture of sustainability, however not in full scale of colors.

The size of specified groups was defined at the sectoral (national) level and in the spatial-regional system. The same approach was used to define the significance of specified groups for the whole of individual agriculture, taking into account the frequency (percent) of the specified farms as well as their share in the arable land, sowing area, labor input (natural persons, fully employed individuals, "marginal" inputs), livestock population, economic strength and

[1] Description of this study together with major data tables are included in: *Charakterystyka gospodarstw rolnych w 2005 r.(Characteristics of Farms in 2005)*, GUS, Warszawa 2006. This publication was mainly based on tabular statements prepared for the needs of task "Socially Sustainable Agriculture" of the multi-annual programme carried out by the Statistical Office, Olsztyn.

[2] J. St. Zegar, *Charakterystyka gospodarstw ekologicznych w Polsce (Characteristics of the Organic Farms in Poland)*, [in:] *Z badań nad rolnictwem społecznie zrównoważonym* (2) (*Research on socially sustainable agriculture (2))*, praca zbior. pod red J.St. Zegara, *Program Wieloletni 2005-2009, zeszyt nr 30 (Multi-Annual Programme 2005-2009, book no. 30)*, IERiGŻ-PIB, Warszawa 2006.

[3] W. Wilk, *Gospodarstwa zrównoważone w świetle danych FADN (Sustainable farms in the light of FADN data)*, [in:] *Z badań nad rolnictwem społecznie zrównoważonym* (2) (*Research on Socially Sustainable Agriculture* (2)), praca zbior. pod red J.St. Zegara, *Program Wieloletni 2005-2009, zeszyt nr 30 (Multi-Annual Programme 2005-2009, book 30)*, IERiGŻ-PIB, Warszawa 2006, no. 30.

prevailing source of income. After that the values of the basic characteristics of the specified farms as well as their differentiation for the whole of the individual agriculture (national level) and at the regional level were presented. Separately the sustainability of the population of agricultural holdings, i.e. farm-related livelihoods, was analyzed. The sustainability of the latter is decisive for the sustainability of the whole of agriculture, not only at present but also in the future. This group experiences the most fundamental changes. The most important is the polarization – weakening and disappearing of weaker and strengthening of stronger farms. The said farms were grouped according to selected sustainability and area group criteria. Other groups of farms – which are not the main source of income for families – undergo the relatively long-term process of gradual limitation of production (at least the market production) and disappearance. The total is summed up with final remarks and conclusions.

Finally we would like to make a technical remark: the tables and figures were prepared independently on the basis of data generated for the need of realization of task "Socially Sustainable Agriculture" of the Multi-Annual Programme carried out by the Statistical Office in Olsztyn. Therefore, if not stated otherwise, no additional information on source was put under the tables and figures.

2. The adopted farm sustainability criteria under the environmental-production aspect

The concept of agricultural sustainable management means the usage of agricultural practices which do not violate the environmental balance, ensure economic profitability and promote social development. The group of sustainable farms determined in this study fulfills the environmental-production standards. Each of the farms characterized by preferable crop and livestock structure was recognized as environment-friendly.

As a sustainable farms under the environmental-production aspect (gospodarstwo zrównoważone w aspekcie środowiskowo-produkcyjnym, GZŚP) or, alternatively, sustainable farm were recognized those which fulfilled simultaneously the 5 following criteria:

- share of cereals in the sowing of arable land (grunty orne, GO) does not exceeded 66%,
- share of winter plants and catch crops in the sowing structure was at least 33%,
- quantity of plant groups cultivated by the farm was at least 3,

- livestock of herbivorous animals and horses has not exceeded the number of 1,5 large animals (sztuka duża, SD) per 1 ha of the main forage area (główna powierzchnia paszowa, GPP)[4],
- livestock of all animals held in a farm does not exceed the number of 2 large animals (SD) per 1 ha of the agricultural area (użytki rolne, UR).

These criteria result from legal regulations binding for beneficiaries of agricultural and environmental programmes[5] as well as from common good agricultural practices[6].

The Agricultural and Environmental Programme is one of the activities within the Rural Areas Development Plan for 2004-2006[7]. The assumption of this programme is to strengthen the best standards of the sustainable agriculture, in particular within the areas threatened by the environmental degradation and protected areas. It includes seven agricultural and environmental activities, called agricultural and environmental packs. Each pack has several detailed requirements which go beyond common good agricultural practices. As agreed, particularly important and measurable packs include "Sustainable Agriculture" (code: S01) and "Protection of Soil and Waters" (code: K01). The first includes limitation of fertilization, balancing of fertilizers' management and observing proper plant succession. The second covers the usage of catch crops in order to increase the share of soils with plant coverage during autumn and winter. The performance criteria for each of particular packs were defined by the environment and agriculture protection experts (including researchers from Institute of Soil Sciences and Plant Cultivation – PIB, Institute of Agricultural and Food Economics – PIB, Institute of Land Reclamation and Grassland Farming).

One of the requirements included in the "Sustainable Development" pack is the share of cereals in the sowing structure. The threshold amount should not exceed 66% of the total sowing structure. In order to determine a group of individual farms characterized by the required cereals level, the species of plants possible classify to the cereal group were indicated: wheat, rye, barley, oats, triticale, cereal mixed, buckwheat, millet, maize for grain, pulses and cereal

[4] This index refers to herbivorous animals, i.e. ruminants (cattle, sheep, goats) and horses, i.e. grazing livestock.

[5] Regulation of the Council of Ministers of 18th January 2005 amending the regulation on detailed conditions and procedure of granting the financial aid to support agricultural and environmental activities as well as to improve the animal welfare, covered by the rural areas development plan; Journal of Laws, no. 22, p. 178 and 179.

[6] *Zwykła Dobra Praktyka Rolnicza (Common Good Agricultural Practice),* FAPA, Warszawa 2003.

[7] *Plan Rozwoju Obszarów Wiejskich na lata 2004-2006 (Rural Area Development Plan for 2004-2006),* MRiRW, Warszawa 2004.

mixed for grain, other cereal. This index allows for partial control of the crop rotation[8] in a farm. The index value is equal to the value adopted for a rational management and integrated production system[9]. Given the simplest crop rotation with three species (e.g. potatoes, oats and rye) and assuming the three-year rotation, the share of cereals amounts to 66,6%. The limitation of cereal share is due to the fact that these plants are qualified as having negative impact on soil. From the biological point of view, the optimum share of cereals in sowing is 50%[10].

The same important issue is the coverage of soils during winter period, which was included in the Agricultural and Environmental Programmes, "Protection of Soils and Waters" pack. The minimum level of soil coverage is 33%. This group includes winter and spring catch crop and species of winter plants (wheat, barley, triticale, cereal mixed, cereal and pulses mixed, rape and colza). Covering the soil with plants in the winter period allows avoiding negative impact of atmospheric conditions (rains, snows, wind) on the soil[11]. The sowing area covered by the winter plants should be as large as possible. This agriculture production organization is possible, however largely farmers do not cultivate winter plants (among others due to the risk of hard frost). Preferable share of agriculture area continuously under the plant coverage IUNG-PIB should be 80%. Also a winter soil coverage index is proposed. It is expressed as a ratio of the area under winter plants, multi-annual plants and catch crops to the total agriculture area. The higher the index value, the less threat of elution of nitrate and better protection of soils against erosion[12].

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[8] Sequence cropping is an intentionally planned succession of plants on a given field resulting from environmental and economic conditions. A plant after which another plant is cultivated, is called "precursor crop"; the plant cultivated after is called – "successive plant". Sequence cropping adopted for a given soil and cultivation complex determined for all rotation and taking into account natural and economic conditions is called Crop Rotation (Płodozmian). See W. Ziętara, *Ekonomika i organizacja przedsiębiorstwa rolniczego (Economics and Organization of the Agricultural Holding)*, FAPA, Warszawa 1998, p. 109, 113.

[9] Principles of Integrated Production and Survey Results are presented in detail in: E. Majewski, *Ekonomiczno-organizacyjne uwarunkowania rozwoju Systemu Integrowanej Produkcji Rolniczej (SIPR) w Polsce (Economic and Organizational Conditions for Development of the Integrated Agriculture Production System (SIPR) in Poland),* Wydawnictwo SGGW, Warszawa 2002.

[10] W. Ziętara, *Ekonomika i organizacja przedsiębiorstwa rolniczego (Economics and Organization of the Agricultural Holding)*, FAPA, Warszawa 1998, p. 109-110.

[11] W. Ziętara, *Ekonomika… (Economics ...)*, *op. cit*., p. 110.

[12] S. Krasowicz, *Cechy rolnictwa zrównoważonego (Characteristics of the Sustainable Agriculture)*, [in:] *Koncepcja badań nad rolnictwem społecznie zrównoważonym (Research on Socially Sustainable Agriculture),* praca zbior. pod red. J. St. Zegara, *Program Wieloletni 2005-2009, zeszyt 11 (Multi-Annual Programme 2005-2009, book 11)*, IERiGŻ-PIB, Warszawa 2005, p. 31-34.

The third indicator related to the plant production organization is the requirement of at least 3 groups of cultivated plants. This criterion obligates the beneficiaries of the activity "Sustainable Agriculture" under the Agricultural and Environmental Programme for 2007-2013[13]. This index was recognized as the most comprehensive and correct as compared to the one used before – three species of cultivated plants – which did not fulfill its function as it was interpreted ambiguously. Indeed, the concept of "plant species" was used frequently in the professional literature, however it cannot be interpreted as cultivation of a defined number of species from one plant group[14]. The assessment of farms on the basis of plants being cultivated allows to determine farms which are characterized by differentiated crop structure. In order to qualify a farm as a sustainable, the cultivation of at least three groups of plants among six provided below was necessary:

1. cereals – wheat, rye, barley, oaks, triticale, cereal mixed, buckwheat, millet, maize for grain, cereal and pulses mixed for grain, other cereal,
2. papilionaceous – pulses for grain, i.e. edible pulses (including peas, bean, broad beans), feed pulses (including: field peas, vetch, field beans, sweet lupine), feed pulses for green fodder products, feed papilionaceous (including: anchovy, other fine grain papilionaceous for green fodder products),
3. root plants – potatoes, sugar beet, root feed plants (including fodder beet),
4. oilseed (industrial) – rape and colza, other oilseed (including: sunflower for grain, soya, oil flax),
5. grasses on agricultural areas (including their mixes with papilionaceous) – field grasses for green fodder products,
6. others – other species not qualified to the above-mentioned groups.

Except the issues related to plant production, also the relation between the plant and animal production at the level of a single farm is important. The crop rotation should ensure the balancing of own fodders and take into account the animal needs, therefore including the possibility to produce fodders on green and arable areas[15]. Therefore one of the requirements towards the beneficiaries

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[13] *Program rolnośrodowiskowy, projekt (The Agricultural and Environmental Programme, draft),* MRiRW, Warszawa, Grudzień 2006.

[14] See *Kodeks dobrej praktyki rolniczej (Code of Good Agricultural Practice)*, FAPA, Warszawa 2002, p. 20; E. Majewski, *Ekonomiczno-organizacyjne uwarunkowania rozwoju Systemu Integrowanej Produkcji Rolniczej (SIPR) w Polsce (Economic and Organizational Conditions for Development of the Integrated Agriculture Production System (SIPR) in Poland),* Wydawnictwo SGGW, Warszawa 2002, p. 81.

[15] *Kodeks dobrej praktyki rolniczej (Code of Good Agricultural Practice)*, FAPA, Warszawa 2002, p. 20.

carrying out the project "Sustainable Agriculture" is to observe the indicated livestock on the main fodder area. The maximum permitted stock is 1,5 of a large ruminant per 1 ha of the main fodder area. In order to determine this relation for the analyzed farms, the calculation coefficients from the Agricultural and Environmental Programme were used to determine the number of large ruminants, based on the number of large animals within particular groups, i.e. cattle, horses, sheep, goats. The main fodder area includes green area and arable area with forage crops for fodder as the main crop. The survey also covers the area under the sugar beet, in order not to eliminate farms which use the sugar beet leaves as preserved fodder products for animals.

A farm may participate in the Agricultural and Environmental activities if it fulfills general conditions for programme accession. The set of binding organizational and production standards, duties and prohibitions is included in the Common Good Agricultural Practices. They result from the regulation on the environment protection. The beneficiaries of the programme must follow these rules within the whole of the farm area (not excluding areas where agricultural and environmental activities are not performed). The ZDPR (Zasady Dobrej Praktyki Rolniczej, Good Agricultural Practices) include the principles on storage and use of fertilizers. It also determines the maximum permissible livestock in the farm (2 large animals per 1 ha of agriculture land), which corresponds to the permissible dose of natural nitrate – 170 kg per 1 ha of agriculture area. The ration of farm animals to the arable land informs about the maximum load of the natural fertilizers in terms of environment. The basis for determining this index and including it into the ZDPR was the so-called Nitrate Directive (91/676/EEC). It determines the maximum number of livestock on the basis of nitrate contained in their dung (natural fertilizers)[16]. Each state individually was obligated to calculate the equivalent of 170 kg expressed in the number of large animals[17]. In Poland the equivalent was determined as the

[16] J. Kuś, *Oddziaływanie dobrej praktyki Rolniczej na gospodarstwo rolne (Impact of the Good Agricultural Practices on Farms)*, [in:] *Z badań nad rolnictwem społecznie zrównoważonym (3) (Research on Socially Sustainable Agriculture (3))*, praca zbior. pod red. J. St. Zegara, Program Wieloletni 2005-2009, zeszyt 52 (Multi-Annual Programme 2005-2009, book 52), IERiGŻ-PIB, Warszawa 2006, p. 29, and J. Kopiński, A. Madej, *Ilość azotu dostarczanego w nawozach naturalnych w zależności od obsady zwierząt (Quantity of Nitrate in Natural Fertilizers depending on the Livestock*, [in:] *Nawozy i nawożenie Nr 4 (29) Rok VIII (Fertilizers and Fertilizing no. 4 (29) Year VIII),* pod red. M. Fotymy, Zeszyt 4/2006, IUNG-PIB, Puławy 2006.

[17] *„Annual dose of natural fertilizer may not include more than 170 kg of nitrate in pure component per 1 ha of agricultural area. It means that environmentally conditioned recommended livestock should not be more than 2 large calculation units (DJP, a cow weighting 500 kg. – 1 DJP) per 1 ha of agricultural land”* (*Common Good Agricultural Practice*, FAPA, Warszawa 2003, p. 15).

interval 1,5-2 SD. The literature legitimates both 1,5 SD/1 ha UR, and 2 SD/1 ha UR[18]. In this study the upper limit proposed by the ZDPR was assumed. Using this index as a criterion for sustainability, the livestock is estimated from the ecological point of view. The use of animal waste as fertilizers, more precisely enrichment of the resources of organic substances in soil, emphasizes the positive impact of the animal production on the environment. However, too intense animal production may become a potential environmental threat (e.g. the emission of ammonia, pollution of the earth water). The environmental limitations of the animal production refer to the stock in the farm[19].

In this paper five requirements were used to identify and analyze the sustainable farms. Among the set of criteria comprehensively assessing the sustainability at the farm level we chose those which could have been verified and calculated on the basis of the existing mass statistics, i.e. the GUS database (structural research). It also became a condition which restricted the comprehensive research scope. Many important organizational and production characteristics which reflect the farm sustainability are not included in the GUS surveys. It was neither impossible to verify the fulfillment of the Good Agricultural and Environmental Condition nor, more widely, the common Good Agricultural Practice. The research includes information which was accessible and important in terms of farm sustainability.

The indexes used in the research bring a significant information load, however they still need to be precise and detailed.

Two criteria concerned sowing structure, i.e. share of cereals and winter plants. It is necessary to verify the possibilities of combining these two conditions at the farm level. Knowing the present state of sowings in Poland, it must be emphasized that most of winter crops are cereals. Therefore many of farms which fulfill the first criterion, do not fulfill another one. In concrete terms, their combination is justified.

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[18] See e.g. H. Jankowska-Huflejt, *Wykorzystanie nawozów gospodarskich na użytkach zielonych zgodnie z wymogami Wspólnej Polityki Rolnej (Use of Fertilizers on Green Agricultural Areas in accordance with Requirements of Common Agricultural Policy",* [in:] „Wieś Jutra" *Warszawa* 2005, no. 3 (80), p. 47 (up to 2 SD); *Kodeks dobrej praktyki rolniczej" ("Code of Good Agricultural Practice")*, FAPA, Warszawa 2002, p. 20 and E. Majewski, *Ekonomiczno-organizacyjne uwarunkowania rozwoju Systemu Integrowanej Produkcji Rolniczej (SIPR) w Polsce (Economic and Organizational Conditions for Development of the Integrated Agriculture Production System (SIPR) in Poland ,* Wydawnictwo SGGW, Warszawa 2002, p. 113 (up to 1,5 SD).

[19] E. Majewski, *Ekonomiczno-organizacyjne uwarunkowania rozwoju Systemu Integrowanej Produkcji Rolniczej (SIPR) w Polsce (Economic and Organizational Conditions for Development of the Integrated Agriculture Production System (SIPR) in Poland),* Wydawnictwo SGGW, Warszawa 2002, p. 113.

The analysis of soil coverage in the winter period includes the winter plants and catch crops. The grasses on arable area were not taken into account as their share in sowing structure is quite insignificant.

Except of using the criteria on sowing structure (i.e. share of cereals, share of winter plants), the farms were classified by the number of cultivated groups of plants. These three conditions aimed at verification of the rotation used by the farm. However, because of the lack of information on particular agricultural plots and their sowing, we cannot be completely sure that all the farms complied with the principle of crop rotation. The rich sowing structure may confirm the likeliness of usage of crop rotation in these farms.

The adopted criteria are not sufficient to comprehensively assess the sustainability of farms. The chosen criteria allowed however to distinguish farms more environment-friendly within the determined environmental and production scope.

The farms using the Norfolk crop rotation were also distinguished and analyzed in the study[20]. It consists of segregation of the agriculture land into four parts and cultivating there species or groups of plants in four-year rotation cycle. The classic four-plot cultivation was developed in England in the 18th century. It included root plants, spring cereals, papilionaceous plants and winter plants. Gradually it spread across Europe and replaced previously used farming systems[21]. The Norfolk system, called also the four-field (czteropolówka) is considered as the proper crop rotation; it also leads to the increase of the soil fertility. Its structure includes 50% of cereals, 25% of structural plants (pulses and fodder plants) and 25% of root plants[22]. *„The ideal would be to use the Norfolk crop rotation (...) which ensures the cultivation of cereals after the precursor crops, i.e. after the non-cereal plants"*[23]. Ensuring the continuous soil fertility is one of the main characteristics of the sustainable agriculture at the farm level. In order to maintain the soil quality it is indispensable to use multi-

[20] Dezydery Chłapowski (born in 17th century) established the four-field Norfolk crop rotation system instead of the triple cropping used at that time. Therefore he expanded the cropping of papilionaceous plants. His earlier stay in England (including Holkham, Norfolk county) allowed him to familiarize with the four-field crop rotation. This is how the Polish name was established.

[21] http://pl.wikipedia.org/.

[22] W. Ziętara, *Ekonomika i organizacja przedsiębiorstwa rolniczego (Economics and Organization of the Agricultural Holding)*, FAPA, Warszawa 1998, p. 109.

[23] S. Krasowicz, *Cechy rolnictwa zrównoważonego (Characteristics of the Sustainable Agriculture)*, [in:] *Koncepcja badań nad rolnictwem społecznie zrównoważonym (Concept of Research on Socially Sustainable Agriculture)*, praca zbiorowa pod red. Zegar J.S., *Program Wieloletni 2005-2009, zeszyt 11 (Multi-Annual Programme 2005-2009, book 11)*, IERiGŻ-PIB, Warszawa 2005, p. 30.

crop rotations with the use of papilionaceous plants and catch crops for green fertilizers. It also justifies the need for further analysis of the Norfolk system.

The plant structure close to the one indicated in the Norfolk crop rotation was established for the purpose of this study. The assumed differences (presented below) were intentional, as the current agriculture production conditions allow to consider the max. 60% share of cereals as justified. The selection of farms was based on the following assumptions:

- sowings on agriculture land – 100%,
- maximum 60% of cereals – species: wheat, rye, barley, oats, triticale, cereal mixed, buckwheat, millet, maize for grain, cereal and pulses mixed for grain, other cereal,
- minimum 20% of pulses, fodder plants – species: pulses for grain, i.e. edible pulses (including peas, bean, broad beans), feed pulses (including: field peas, vetch, field beans, sweet lupine), feed pulses for green fodder products, feed papilionaceous (including: anchovy, other fine grain papilionaceous) for green fodder products, field grass for green fodder products, other fodder plants on agriculture land for green fodder products,
- maximum 20% of root plants and other species: root plants – potatoes, sugar beet, root feed plants (including fodder beet), oilseed (industrial) – rape and colza, other oilseed (including: sunflower for grain, soya, oil flax), other industrial, vegetables and field strawberries in crop rotation with agricultural crops, maize for green fodder products, other species not qualified to the above mentioned groups.

The farms characterized by this sowing structure were qualified as „Norfolk farms".

Lack of breeding animals in the farm is the criterion for recognizing a farm as "non-inventory". The criterion for recognizing a farm as "subsistence farm" is the 50% or more share of products consumed by the farm as compared to the final production output.

3. Distribution of farms that fulfill the selected sustainability criteria

One of the characteristics of the Polish agriculture is agricultural dispersion which is reflected in large number of small farms. The dispersion is not favorable for sustainable farming, in particular it does not ensure proper income for agricultural families and significant share of farms focuses more on own needs (natural consumption) than on market needs, it eliminates the need of animal breeding.

First we have to determine the number of farms which fulfill the five criteria of environment and production sustainability (abbreviated: sustainable farms), farms using the Norfolk crop rotation (abbreviated: Norfolk), non-inventory farms and subsistence farms. The determined group of farms is not disjoint. Contrary, they overlap each other (table 1).

Table 1. Crossing of sizes of specified groups of farms (percent)

Item	Total	Sustainable	Norfolk	Non-inventory	Subsistence
Total	100,0	100,0	100,0	100,0	100,0
Sustainable	1,6	100,0	10,0	0,6	1,4
Norfolk	2,1	12,9	100,0	0,4	2,3
Non-inventory	37,4	14,4	7,0	100,0	37,4
Subsistence	41,0	35,7	44,6	41,1	100

Table 2. The number of individual farms by specified groups and voivodships (T)

Details	Individual farms				
	Total	Sustainable	Norfolk	Non-inventory	Subsistence
Polska	2 472,8	40,1	51,6	925,6	1 015,0
dolnośląskie	115,3	1,8	0,1	58,7	44,0
kujawsko-pomorskie	101,1	2,7	1,2	31,4	28,9
lubelskie	279,4	5,8	3,0	104,3	93,5
lubuskie	45,1	0,4	0,1	21,0	21,0
łódzkie	182,0	1,3	1,4	58,1	52,6
małopolskie	312,7	6,0	17,6	107,2	186,8
mazowieckie	317,5	2,2	4,6	128,7	80,0
opolskie	59,9	1,0	0,0	21,4	25,1
podkarpackie	273,4	11,0	7,1	92,2	179,4
podlaskie	110,3	0,6	4,7	36,6	29,3
pomorskie	62,7	0,8	1,3	24,1	23,8
śląskie	185,5	1,0	3,1	90,5	103,1
świętokrzyskie	132,1	2,6	2,7	41,5	51,8
warmińsko-mazurskie	63,1	0,7	3,5	23,2	23,5
wielkopolskie	177,9	1,6	0,8	57,8	50,4
zachodniopomorskie	54,9	0,5	0,4	28,9	21,9

The number of individual farms by distinguished groups and voivodships is shown in table 2. The analysis does not include the organic farms the number of which is quite insignificant to date (in 2005 – 4 thousand, currently approximately 8 thousand). These farms are concentrated in voivodships characterized by a significant number of individual farms and attractive in terms of natural conditions. In four voivodships: małopolskie (725 of organic farms), świętokrzyskie (543), lubelskie (480) and podkarpackie (429) 54% of all organic

farms are located. The characteristics of these farms are included the previous report [24].

The data of table 2 confirm the supposition on results of the agricultural dispersion. The number of farms orientated towards subsistence – i.e. more than a half of the production is intended for natural consumption – exceeded one million of farms (41% of the total of individual farms maintaining the agricultural activity). Also significant is the number of non-inventory farms – it exceeded 900 thousand (37,4%). It implicates significant changes of the agricultural production organization. The so-called „krowa-żywicielka" ("cow-feeder") becomes a thing of the past – more and more farms cease to hold the stock animals. The economic factors play an important role in this field – small-scale breeding is not economical. Also everyday inconveniences, the need of time and supervision are inseparable from farm activities. The number of Norfolk farms and sustainable farms amounts to, respectively, 51,6 and 40,1 thousand, i.e. 2,1 and 1,6% of the total number of farms. Indeed, the share is not significant. However, if expressed in absolutes, they become quite large numbers.

The subsistence farms are most numerous in regions characterized by high degree of dispersion: podkarpackie and małopolskie. In these voivodships there are 366 thousand of subsistence farms, i.e. 36% of the total of such farms. These numbers would even reach respectively 470 thousand and 46% if the śląskie voivodship was included.

The non-inventory farms are placed a little bit more evenly at the regional level. The ranking of voivodships looks also slightly different. In the first three voivodships: mazowieckie, małopolskie and lubelskie there are 340 thousand non-inventory farms located, i.e. almost 37% of the total of such farms.

Remarkably, the Norfolk farms are concentrated in małopolskie voivodship (34% of such farms). At the other extremity there are post-PGR farm (former state farms) voivodships, where the frequency of such farms is marginal.

The farms matching the environmental and production sustainability criteria (i.e. farms called sustainable) are distributed more evenly at the regional level, however podkarpackie voivodship is predominant in this regard (28% of all such farms).

Obviously, the frequency of individual farms differs significantly between voivodships (due to size of agricultural land, area structure). Therefore it seems to be justified to compare the frequency of selected groups of farms to the total

[24] Praca zbior. pod red. J.St. Zegara, *Z badań nad rolnictwem społecznie zrównoważonym (2), Program Wieloletni 2005-2006, zeszyt 30 (Research on Socially Sustainable Agriculture, Multi-Annual Programme 2005-2006, book 30),* IERiGŻ-PIB, Warszawa 2006.

number of farms in particular voivodships. The subsistence farms predominate (>50% of the total number of farms) in regions where agriculture is dispersed: podkarpackie, małopolskie and śląskie. The smallest share of such farms (25-29%) was observed in voivodships with relatively better-developed peasant's (family) agriculture or less developed non-agricultural labor market and with more difficult access to place of work. The first group includes: wielkopolskie, kujawsko-pomorskie and łódzkie, the second: podlaskie. This group also includes mazowieckie voivodship.

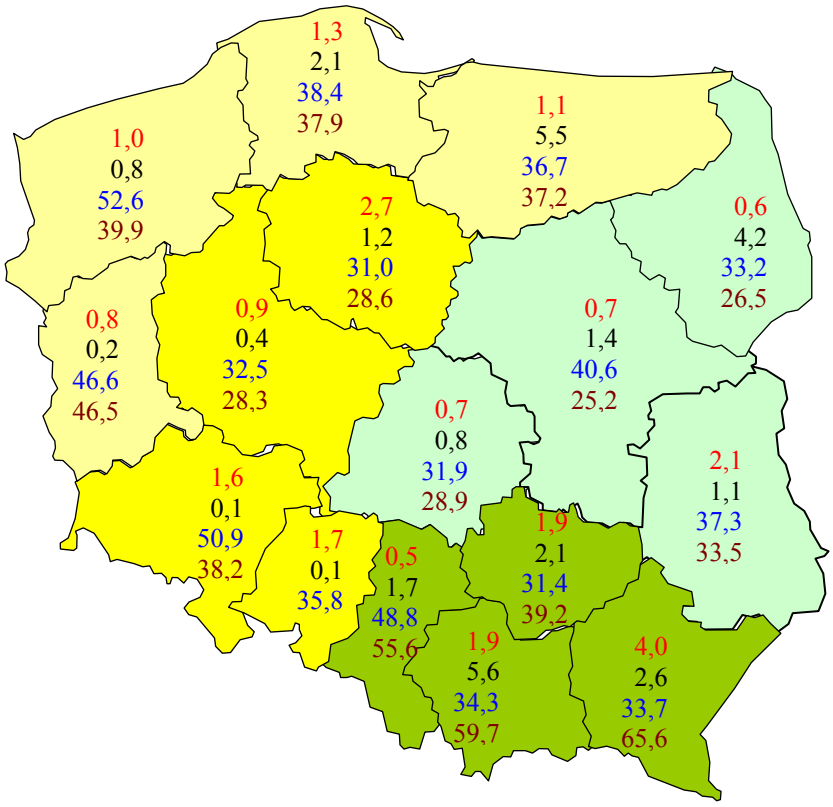
The non-inventory farms predominate in zachodniopomorskie and dolnośląskie. Their share is the same large as in other post-PGR voivodships. However, in any case it does not fall below 30%.

The share of Norfolk farms is the highest in voivodships substantially disparate: małopolskie, warmińsko-mazurskie and podlaskie. Similarly, it refers to marginal share of Norfolk farms in dolnośląskie, lubuskie and zachodniopomorskie as well as śląskie, podlaskie, mazowieckie, łódzkie and wielkopolskie.

The table 2 and map 1 presents distribution of frequency of sustainable farms, which means that they match all the 5 environmental and production sustainability criteria. Particular criteria are fulfilled by different number of farms. The easiest to comply with is the livestock per agricultural area criterion – in only 3% of farms the livestock exceeded 2 SD. It means that natural fertilization in these farms exceeded 170 kg of nitrogen per 1 ha UR. It may suggest that approximately 60 thousand farms holding 15% of livestock (SD), including 6% of livestock of cattle and 16% of livestock of pigs, are non-compliant with the requirements of the Nitrate Directive.

The farms which do not match the SD/UR criterion are relatively smaller in terms of their area. Some of them has only a small farming center or modest agricultural area and hold a large number of livestock, in particular pigs and poultry. Therefore these farms were characterized by holding large livestock. The farms with lack of agricultural areas and simultaneously with large number of livestock, seriously threaten the environment as practically no fertilizers turnover is observed (including market turnover and cooperation between neighbors). This in turn translates into the point threat to the environment caused by overproduction of nitrate by 3% of farms characterized by intense animal production. Simultaneously these farms are the strongest in economic terms (tab. 3).

Map 1. Share of sustainable, Norfolk, non-inventory and subsistence farms[a] by voivodships and FADN macro-regions



FADN Macro regions:
I – Pomorze i Mazury
II – Wielkopolska i Śląsk
III – Mazowsze i Podlasie
IV – Małopolska i Pogórze

Groups of farms (%):
Sustainable farms
Norfolk farms
Non-inventory farms
Subsistence farms

[a] It is not allowed to sum up percentages of particular groups of farms, as these are disjoint sets.

Table 3. Selected characteristics of individual farms in total, farms matching and do not matching the SD/UR criterion (requirements of the Nitrate Directive)

Item	Individual farms		
	Total	≤ 2 SD/UR	>2 SD/UR
Frequency of farms (thousand)	2 472,8	2 410,1	62,7
Total area of farm (ha)	6,3	6,3	4,8
UR area of farm (ha)	5,5	5,5	4,1
- arable land as part of the agricultural land (%)	76	76	80
including: sowings (%)	95	95	99
- permanent green areas as part of the agricultural land (%)	21	21	18
Share of farms below 1 ha in group (%)	32	31	57
Number of fully-employed (JPZ)	0,9	0,9	1,1
Livestock per farm (SD)	2,9	2,5	17,8
Share of livestock in group (%)	100	85	15
Share of cattle in group (%)	100	94	6
Share of pigs in group (%)	100	84	16
Share of agricultural holdings[a] in group (%)	27	27	31
Economic size of farm (ESU)	3,3	3,2	8,7

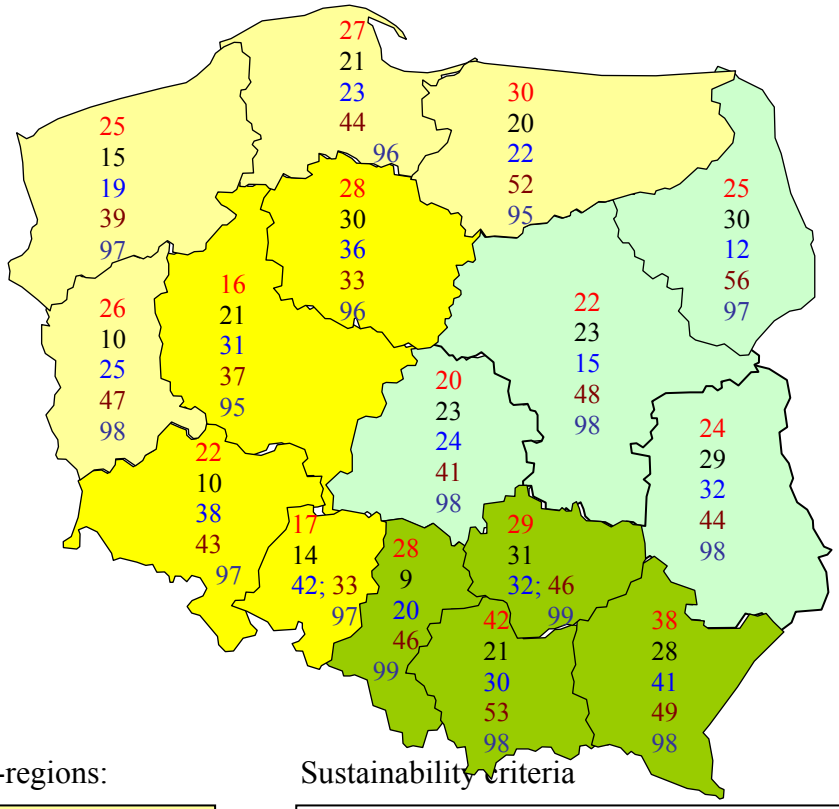
[a] Farms with predominant share of incomes from agricultural activity

The ruminant livestock criterion (production of fodders which covers the need of ruminants) was matched by 46% of individual farms. Non-inventory farms accounting for 37% of the total of individual farms match this criterion *ex definitione*. 210 thousand (approximately 14%) of farms holding the animal stock also matched this criterion. Other farms holding the animal additionally purchased the fodders. The winter crops criterion was matched by 28% of farms. 27% of farms fulfilled the cereals criterion. The smallest number of farms (only 22%) matched the criterion of plant groups (rotational cropping).

For clear reasons groups of farms matching the selected environmental and production criteria are not separate. They are significantly different both in terms of frequency and fulfillment of selected criteria. For example the sustainable farms account for 5,9% of farms matching the cereals share criterion, 7,2% of farms matching the groups of plants criterion, 5,8% of farms matching the winter crop criterion, 3,6% of farms matching the SD/GPP criterion and merely 1,7% of farms matching the SD/UR criterion.

The voivodships are strongly differentiated in terms of frequency of fulfillment of particular criteria.

Map 2 : Share of farms matching selected criteria by voivodships



FADN Macro-regions:

I – Pomorze i Mazury
II – Wielkopolska i Śląsk
III – Mazowsze i Podlasie
IV – Małopolska i Pogórze

Sustainability criteria

Share of cereals – max. 66%
Groups of plants – min. 3
Share of winter crops – 33%
Stock of ruminants SD/GPP – max. 1,5
Stock of all animals SD/UR – max. 2

4. Selected groups of farms against the background of the general population of individual farms

The significance of selected groups of farms will be analyzed at national and regional level. Due to the low accessibility of data we will only analyze the significance in terms of land resources, labor input, livestock, economic strength and sources of income. Surely, it does not fully explore the possible set of indexes describing the significance of the selected groups of farms in individual agriculture, in particular as regards social agriculture. The measure of significance is expressed as share of selected criteria in the whole of the individual agriculture, within said economic categories.

Table 4. Individual farms by selected groups – selected data

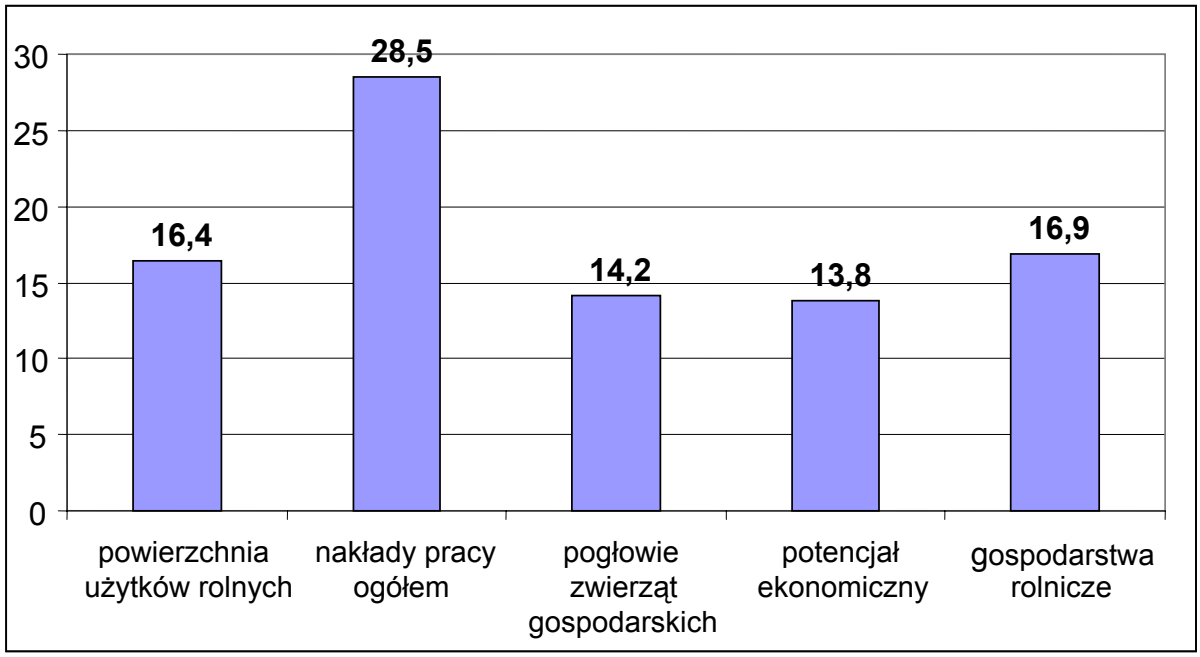
Item	Individual farms				
	Total	Sustainable	Norfolk	Non-inventory	Subsistence
Agriculture land (thousand ha)	13 605,8	509,2	390,4	2 859,7	2 228,7
Sowings (thousand ha)	9 843,4	437,3	292,2	1 879,4	1 313,6
Labor input (thousand JPZ[a])	2 246,9	59,0	73,5	355,6	640,8
- families (thousand JPZ)	2 146,7	55,3	72,1	314,2	630,6
Working in farm (thousand person)	5 044,3	101,2	130,4	1 473,3	1 952,2
- 65 years old and older	750,0	11,7	18,8	231,6	386,5
Livestock (thousand SD)	7 222,5	154,8	278,1	0,0	1 028,5
Economic potential (million ESU)	8 209,8	312,4	224,1	1 286,6	1 136,7
Agricultural holdings (thousands)	664,2	17,2	17,9	131,6	112,0

[a] JPZ – fully employed individual, alternatively annual work unit (AWU, roczna jednostka pracy). It is an equivalent of one full time job. The work unit used in Poland was equal to 2.120 hours of work per year, i.e. 265 working days, 8 hours of work each day. When computing the labor input expressed in JPZ (according to the Eurostat methodology) the condition was maintained that 1 person may not correspond to more than 1 JPZ, even if it works longer in reality.

Subsistence farms, accounting for 41% of the total population of individual farms, have much less economic and production significance. They use approximately 2,2 million ha of agricultural land; it corresponds to 640 000 JPZ of labor input, a little bit more than 1 million SD of livestock and 1,1 million ESU. These numbers are not surprising. However, the group of subsistence farms, i.e. earning their incomes mainly from farming activity, would require closer investigation. Most of the production generated by these farms is intended for internal consumption (natural consumption). If compared with the source of income criterion, it indicates that consumption of food from subsistence predominates in consumption structure of the holding (family) in this group. It may indicate to exceptionally low level of non-food needs resulting from, e.g. older age or poverty. In any case, this is the focus group which includes more than 110.000 households.

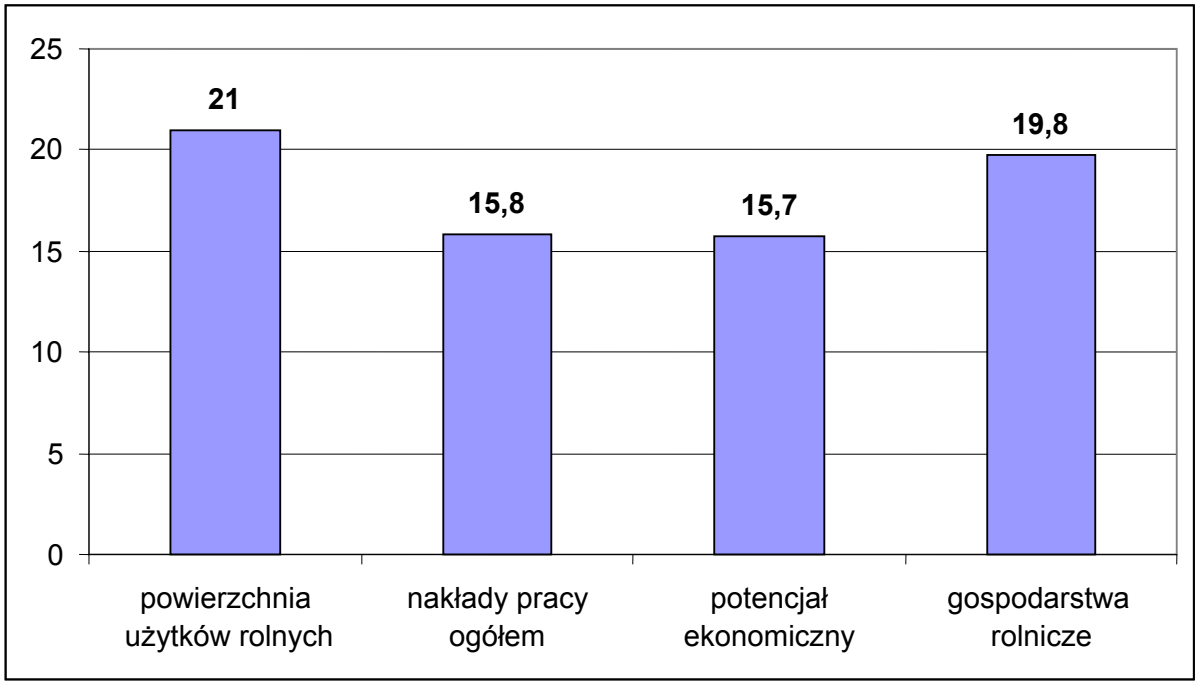
Non-inventory farms account for 37,4% of the total of individual farms. This is a large group (926.000) and its size is still increasing. These farms use 3,3 million of agricultural area in total, engaging almost 360 000 JPZ of labor input. It is also a basic – i.e. predominating – source of income for 132.000 of households.

Fig. 1. Subsistence farms against background of the total population of individual farms (%)



powierzchnia użytków rolnych – agricultural area
nakłady pracy ogółem – total labor input
pogłowie zwierząt gospodarskich – stock of farm animals
potencjał ekonomiczny – economic potential
gospodarstwa rolnicze – agricultural holding

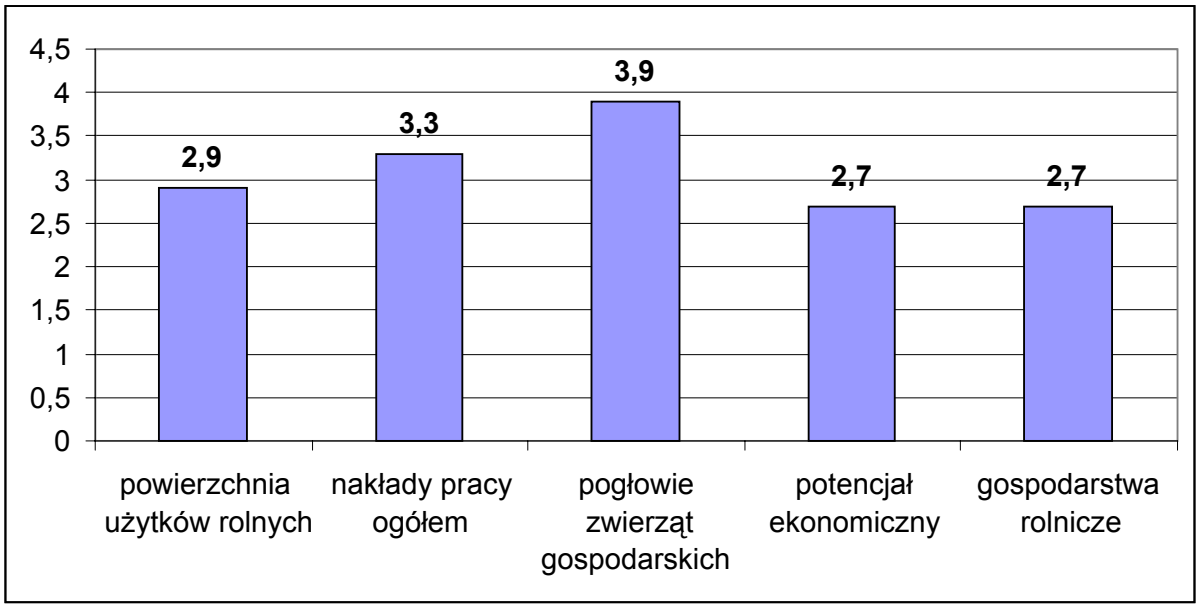
Fig. 2. Non-inventory farms against background of the total population of individual farms (%)



Powierzchnia użytków rolnych – agricultural area
nakłady pracy ogółem – total labor input
potencjał ekonomiczny – economic potential
gospodarstwa rolnicze – agricultural holding

The group of Norfolk farms includes more than 50.000 farms (2,1% of the total of individual farms), uses 390.000 ha of agricultural area, engages 73.000 JPZ of labor input and holds 278.000 of animals. They are the basic source of income for 17.900 families (households), which means that 35% of these farms are of farming character.

Fig. 3. Norfolk farms against background of the total population of individual farms (%)

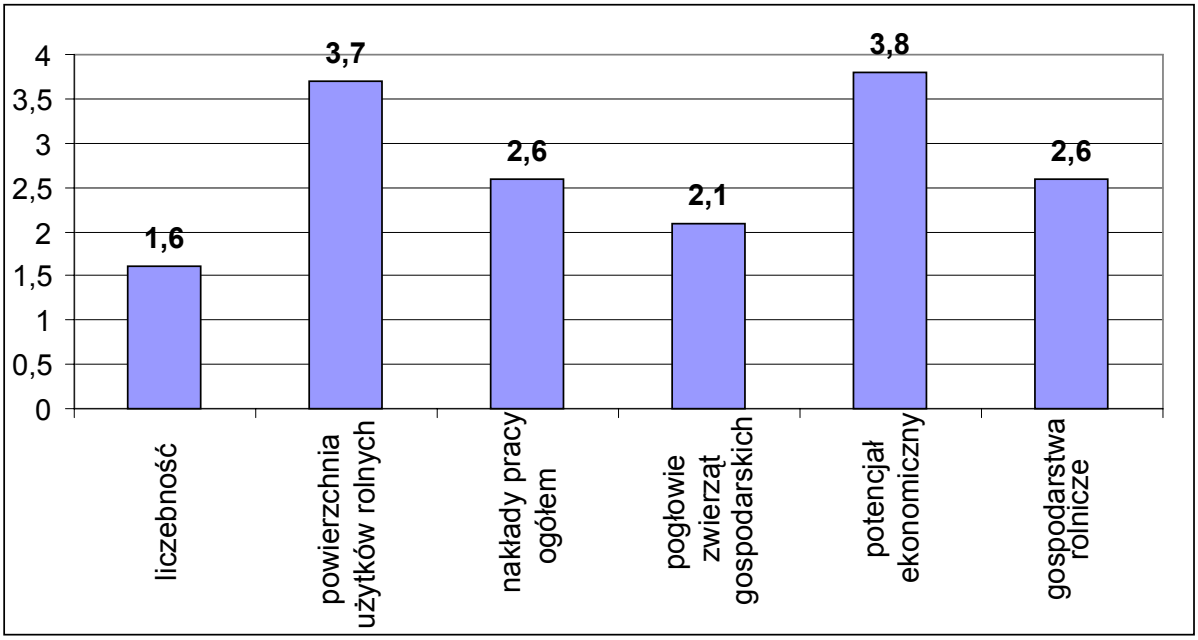


powierzchnia użytków rolnych – agricultural area
nakłady pracy ogółem – total labor input
pogłowie zwierząt gospodarskich – stock of farm animals
potencjał ekonomiczny – economic potential
gospodarstwa rolnicze – agricultural farms

The group of sustainable farms, i.e. matching all the 5 environmental and production sustainability criteria includes only 40.000 farms (1,6% of the total of individual farms) and therefore has marginal economic and production importance. It uses only 510.000 ha UR, engages less than 60.000 JPZ of labor input and holds 155.000 SD of stock of animals. Approximately 42% of farms in this group have an agricultural source of income. Farms of this group are interesting however, because they are very close to match the economic and social criterion (source of income) and environmental and production criteria, It is expected that political instruments, in particular resulting from the EU agricultural policy will have an impact on increase of frequency *eo ipso* significance of this group of farms.

Significant differences in terms of share of selected farm groups in basic values of the individual agriculture at the regional level are observed in terms of spatial configuration.

Fig. 4. Sustainable farms against background of the total population of individual farms (%)

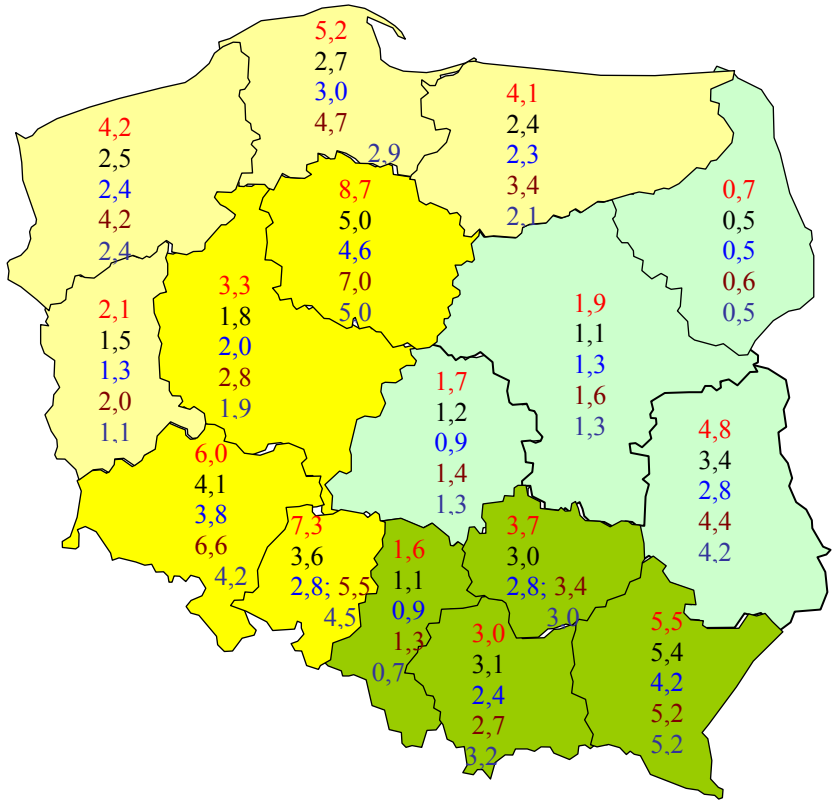


liczebność - frequency
powierzchnia użytków rolnych – agricultural area
nakłady pracy ogółem – total labor input
pogłowie zwierząt gospodarskich – stock of farm animals
potencjał ekonomiczny – economic potential
gospodarstwa rolnicze – agricultural holding

As regards the sustainable farms, taking into account their marginal role in basic production and economic categories, relative differences are observed between particular regions. Beyond any doubt, the population of sustainable farms is far more important in Pomorskie, Opolskie, Dolnośląskie, Podkarpackie as compared to Łódzkie or Śląskie voivodships. For example, in terms of agricultural area, the share of sustainable farms in the first group of voivodships exceeds 5%, while in the second group does not exceed 2% of the agricultural areas in a given voivodship.

It is similar in case of significance of Norfolk farms, which are more numerous as compared to the sustainable farms. In this regard Warmińsko-Mazurskie, Małopolskie and Podlaskie are in the first rank. Opolskie, Dolnośląskie and Lubuskie are in the last rank in this regard. In the first group the share of Norfolk farms in the agricultural area exceeds 8%, while in the second group it does not exceed 0,3%.

Map 3. Sustainable farms against the background of the genera population of individual farms – basic characteristics from regional perspective (%)



FADN macro regions

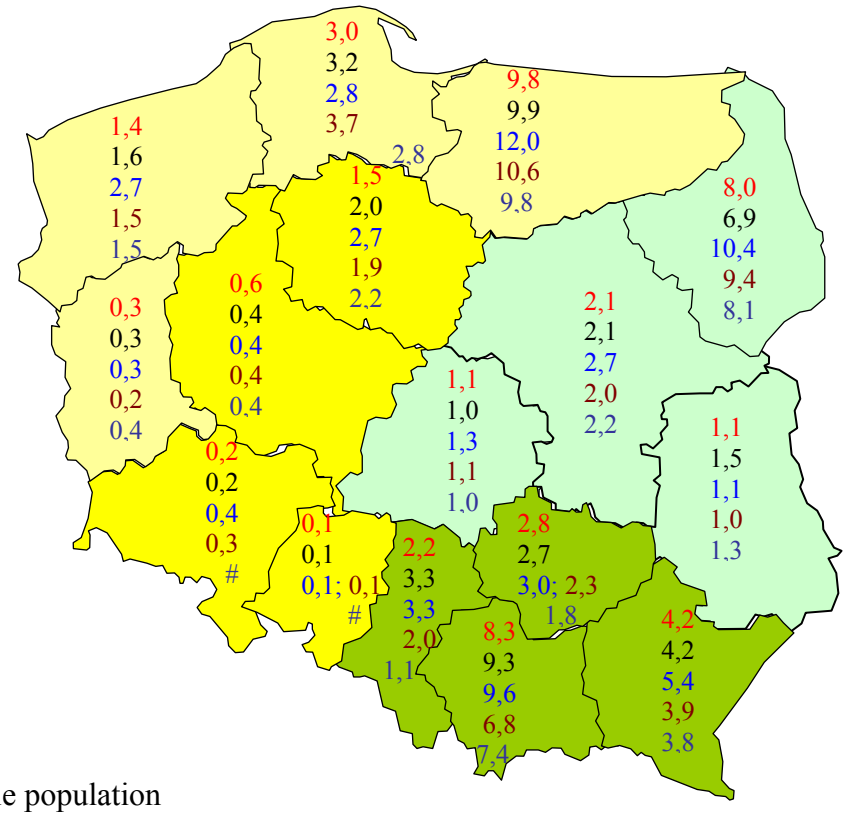
- I – Pomorze i Mazury
- II – Wielkopolska i Śląsk
- III – Mazowsze i Podlasie
- IV – Małopolska i Pogórze

Characteristics (%):

- Share of agricultural areas
- Share of labor input
- Share of livestock
- Share of economic strength
- Share of farms with predominant income from farming activity

The non-inventory farms play an important role in individual agriculture of voivodships dominated by traditional agricultural organization. Share of this farm group fluctuates around 1/5 of the relevant values for the whole of the individual agriculture. Mostly distinguishable are however the post-PGR voivodships – the said percentage value fluctuates around 1/3.

Map 4. Norfolk farms against the background of individual farms – basic characteristics from regional perspective (%)



– Too little population

FADN macro-regions:

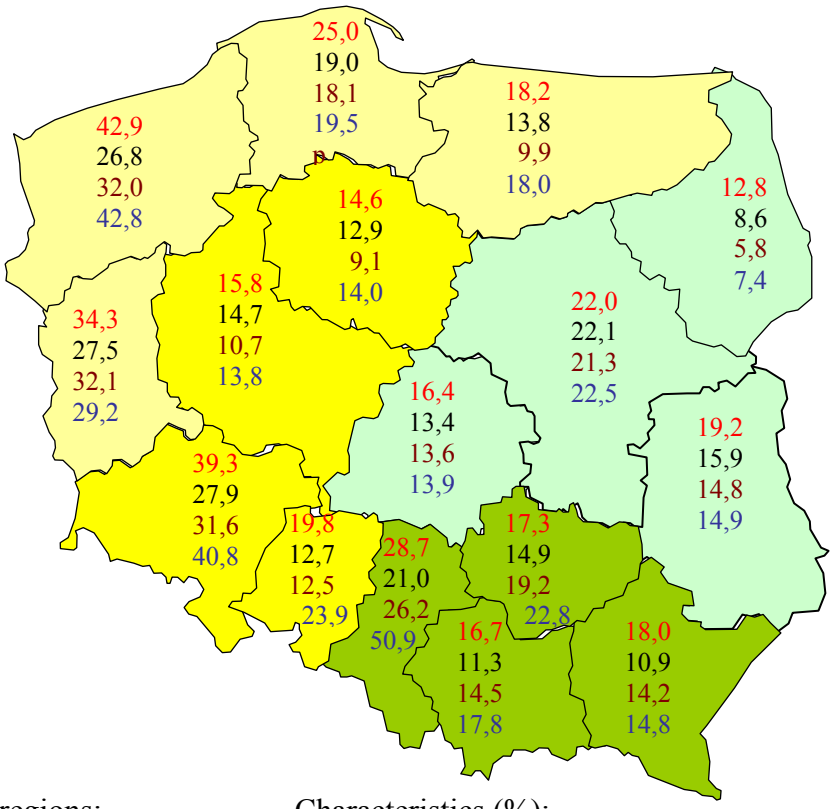
I – Pomorze i Mazury
II – Wielkopolska i Śląsk
III – Mazowsze i Podlasie
IV – Małopolska i Pogórze

Characteristics (%):

Share of agricultural areas
Share of labor input
Share of livestock
Share of economic strength
Share of farms with predominant income from farming activity

The group of subsistence farms is large and plays an important role in individual farming of particular voivodships. These farms dominate in voivodships with dispersed and historically conditioned agriculture. However, also in other voivodships, including the post-PGR, this group remains significant.

Map 5. Non-inventory farms against the background of individual farms – basic characteristics from regional perspective (%)



FADN macro-regions:

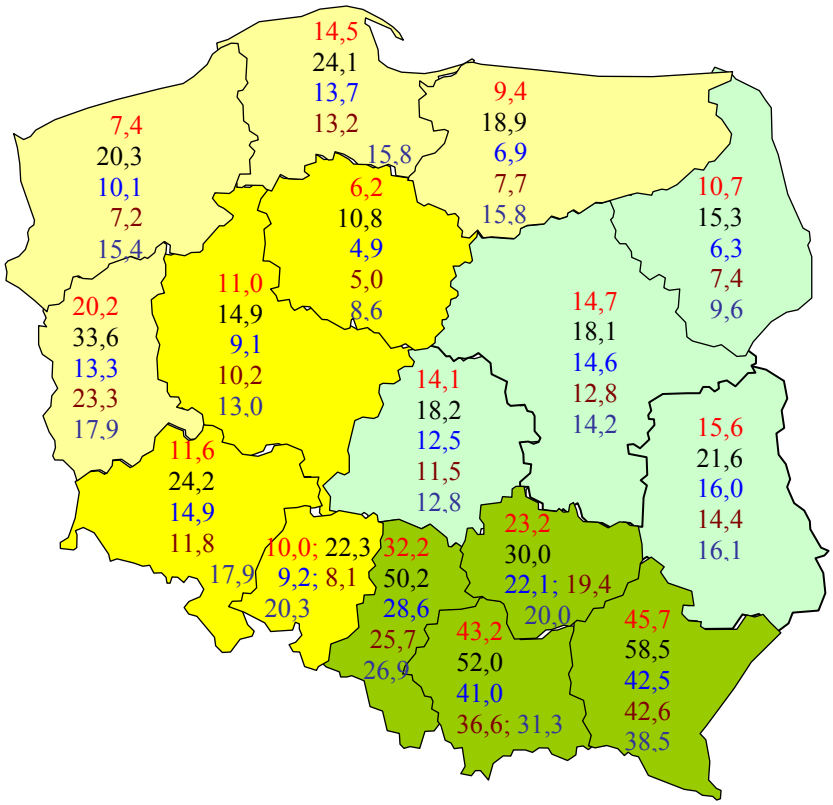
- I – Pomorze i Mazury
- II – Wielkopolska i Śląsk
- III – Mazowsze i Podlasie
- IV – Małopolska i Pogórze

Characteristics (%):

- Share of agricultural areas
- Share of labor input
- Share of economic strength
- Share of farms with predominant income from farming activity

Ilustration in the form of maps of significance of selected farms in individual agriculture of particular voivodships is a general picture which indicates to large differences between voivodships. It does not explain however the reasons for this differentiation. To some extent the average values of selected characteristics of farms in particular voivodships may be helpful in explaining this issue. They are contained in the next (4) part of this study. Whatever the explanation will be, it cannot be regarded as satisfactory. This issue requires further analysis but this is not the objective of this study. This issue will be evaluated in another work.

Map 6. Subsistence farms against the background of individual farms – basic characteristics from regional perspective (%)



FADN macro-regions:

I – Pomorze i Mazury
II – Wielkopolska i Śląsk
III – Mazowsze i Podlasie
IV – Małopolska i Pogórze

Characteristics (%):

Share of agricultural areas
Share of labor input
Share of livestock
Share of economic strength
Share of farms with predominant income from farming activity

5. Basic characteristics of individual farms in selected groups

Our analysis of selected farm groups will be limited to the most basic characteristics on soil, labor input, livestock, economic potential and sources of income. We will use the simplest measure for determining the value of the characteristics, namely the arithmetic mean for selected farm groups and certain average ratios between characteristics.

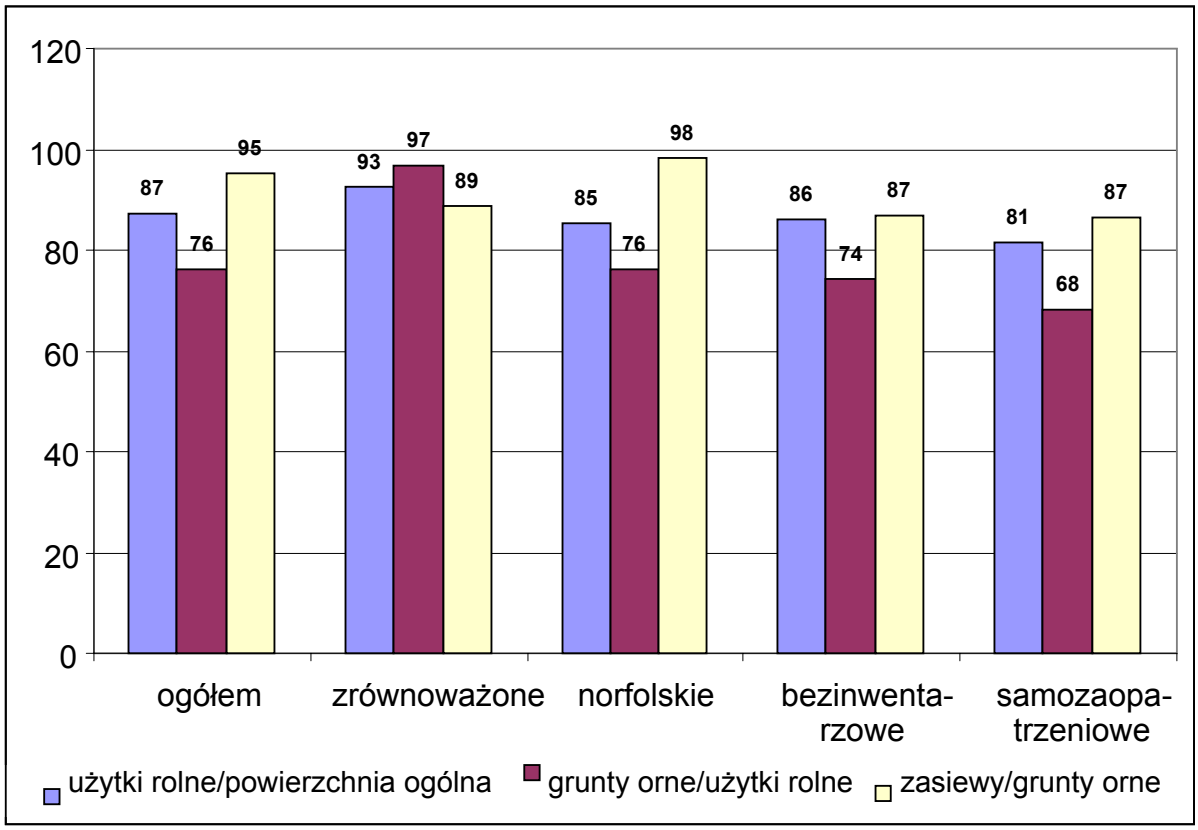
Table 5. Basic characteristics of selected groups of individual farms (average per 1 farm)

Item	Individual farm				
	total	sustainable	Norfolk	non-inventory	subsistence
Agricultural area (ha)	5,5	12,7	7,6	3,1	2,2
Labor input (JPZ)	0,91	1,47	1,42	0,38	0,63
Livestock (SD)	2,92	3,86	5,39	-	1,01
Economic potential (ESU)	3,3	6,7	4,3	1,4	1,1
Agricultural farms (% in group)	27	43	35	14	11

The sustainable farms stand out against the background of the whole of individual farms. It is due to the fact that they use 2,3 times larger area UR, use 1,6 times more labor input and hold 1,3 times more of livestock. In total their economic potential is 2 times bigger. The agricultural farm is the main source of income for 43% of subsistence farms, i.e. 1,6 times more often as compared to the whole of farms. As regards the sustainable farms, the most similar are Norfolk farms, the least similar non-inventory and subsistence farms. Smallest area of the agricultural land characterizes subsistence and non-inventory farms. These are mainly disappearing farms – which either stop or limit their agricultural activity. The difference in average area of arable lands for subsistence and sustainable farming is of the order 5.7 times while for non-inventory farming of the order 4.7 times. In these groups of farms also the percentage of area of agricultural land, arable land and sowings is lower. As the result of aggregation effect, the ratio of sowing area to area of agricultural land is as little as 59% for subsistence farms, 64% for non-inventory farms, 75% for Norfolk farms and 86% for sustainable farms (for the whole of farms it amounts to 73%).

In terms of human factor, the differentiation of sustainable farms refers not only to labor input expressed in contractual full employment units (JPZ) but also in share of labor input of family in total labor input, number of individuals in the family engaged in activities within the farm, relation of the number of household members to labor input (i.e. individuals to JPZ), users 65 years old or older, users with agricultural education.

Fig. 5 Ratios of agricultural areas in selected groups of individual farms (%)



ogółem – in total
zrównoważone – sustainable
norfolskie – Norfolk
bezinwentarzowe – non-inventory
samozaopatrzeniowe – subsistence
użytki rolne/powierzchnia ogólne – agricultural land/total area
grunty orne/użytki rolne – arable area/agricultural land
zasiewy/grunty orne – sowings/arable land

Table 6. Selected characteristics of labor factor in selected groups of individual farms (average per 1 farm)

Item	Individual farms				
	total	sustainable	Norfolk	non-inventory	subsistence
Family work as % of labor input	95,6	93,9	98,6	89,5	98,4
Household members engaged in farm activities	2,04	2,59	2,53	1,59	1,92
Individuals/JPZ (family)	2,35	1,75	1,81	4,69	3,10
Users 65 years old or older	17,1	10,8	16,5	18,9	23,8
Users with agricultural education	38,5	58,5	48,0	26,9	28,1

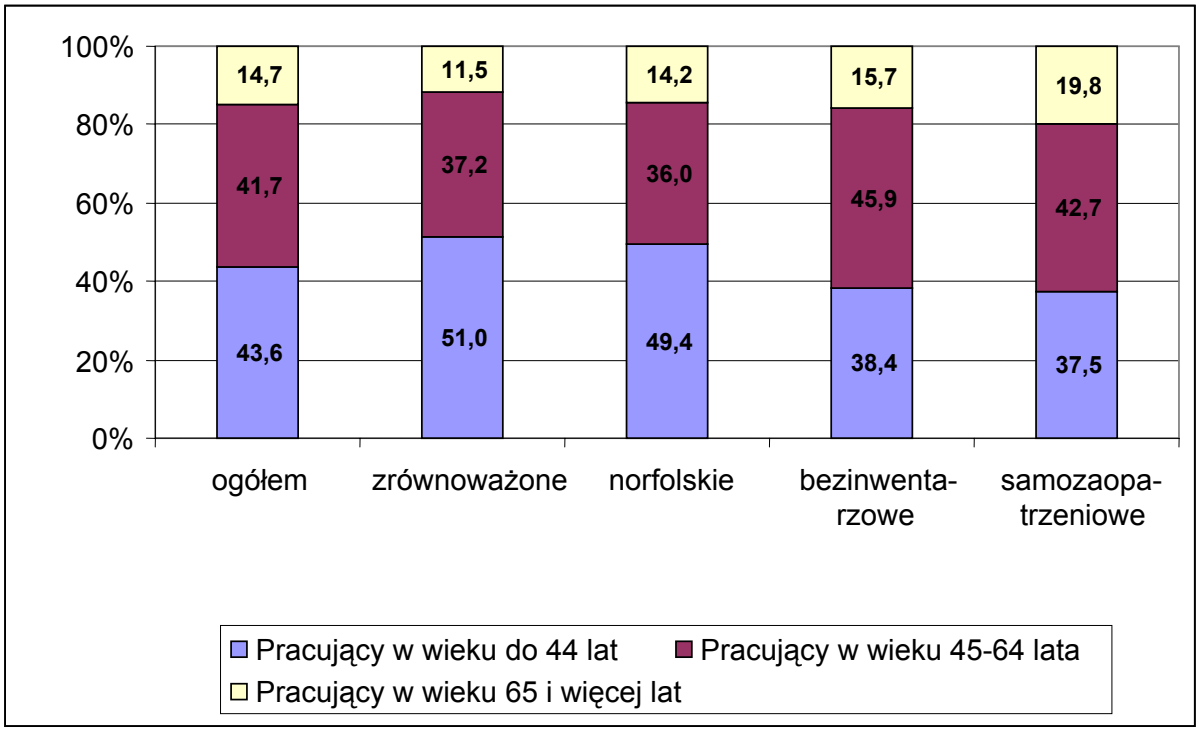
Sustainable farms employ slightly more of contract workers as compared to the average for the whole of individual farms, however they are behind the non-inventory farms (horticultural farms to large extent). Similarly as the

Norfolk farms, the subsistence farms substantially do not use contract work. As regards the sustainable farms, the labor input equal to 1 JPZ consist of 1,75 of individuals (household members) – ¼ less as compared to the average individual farm. As regards the subsistence farms, the same 1 JPZ consists of as much as 3,10 of individual and non-inventory farms may even need 4,69 persons in this regard. In the last group of farms the household members work partly, not full time. It is supported by the fact that for only 14% of farms in this group the farming activity is the main source of income. In the whole population this percentage amounts to as much as 27%. Moreover, the non-inventory farms are economically weaker (1,4 ESU), less effective and worse organized. 50% of farms in this group have less than 1 ha of area (average is 30% for the whole of farms). Larger resources of own work characterize small farms. However, this work is used only part-time.

The sustainable farms are clearly different to the whole of farms, the more to subsistence and non-inventory farms, in terms of agricultural education and age of users. The percentage of users with agricultural education in sustainable farms is 20 p.p. higher as compared to the whole of population, ca. 30 p.p. higher as compared to subsistence farms and 10 p.p. higher as compared to Norfolk farms. Additionally, the percentage of users with higher education in sustainable farms is lower as compared to the whole of farms, however higher is the share of users with higher agricultural education. In principle, agricultural farm is not interesting for individuals with higher education. Only every 20th user of agricultural farm (5,5%) has higher education, in case of users with higher agricultural education, it is a marginal value (1,2%). The same percentages for sustainable farms amount to, respectively 4,6 and 1,9%, for Norfolk farms 2,9 and 0,5% and for subsistence farms 4,4 and 0,6%. In the group of non-inventory farms, almost every 10th (9,7%) user has the higher education, however only 1,8% has the higher agricultural education.

The sustainable farms are characterized by smaller percentage of users at post-working age. This advantage refers to the labor input of the whole of household members.

Fig. 6. Structure of working household members by age in selected groups of farms



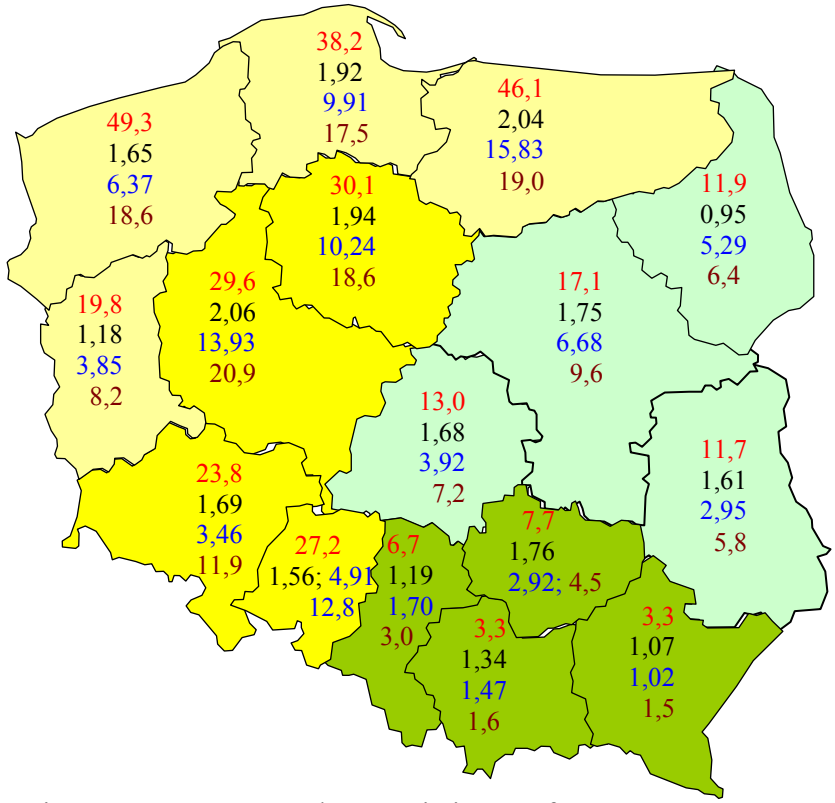
ogółem – in total
zrównoważone – sustainable
norfolskie – Norfolk
bezinwentarzowe – non-inventory
samozaopatrzeniowe – subsistence
pracujący w wieku do 44 lat – working persons up to 44 years old
pracujący w wieku 45-64 lat – working persons 45-64 years old
pracujący w wieku 65 i więcej lat – working persons 65 years and older

The sustainable farms hold larger livestock as compared to the whole of farms. In this regard, they are behind the Norfolk farms. However the livestock is at least twice lower in case of sustainable farms (53 SD/100 ha UR in the total of farms and 29 sustainable). The largest livestock (71 SD) is in the Norfolk farms, the smallest in subsistence farms (46 SD). It can be clarified by the fact that farms cultivating plants according to the Norfolk crop rotation limit the cereals in the structure of sowing and increase the share of structure forming plants, including fodder plants, i.e. edible pulses (peas, beans, broad beans), feed pulses (field peas, vetch, field beans, sweet lupine), feed pulses for green fodder products, feed papilionaceous (including: anchovy, other fine grain papilionaceous) for green fodder products, field grasses for green fodder products and other fodder plants on arable area for green fodder products. Fodder plants o arable areas are mainly cultivated in farms which hold animals, mainly ruminous. Feed pulses are important in terms of structure forming; however they are also used as fodders for animals. These are very valuable

fodders which contain large amount of proteins. Therefore, when isolating the group of Norfolk farms, the farms with more environmental friendly sowing structure which hold the ruminants, were also selected. This supposition is confirmed by the livestock structure, where the cattle accounts for 84% as compared to 55% for the whole of individual farms. It translates into reverse relations as regards the pigs (31% for the whole of individual farms and respectively 8% for Norfolk farms). Therefore the Norfolk farms relatively more frequently specialize in breeding and rearing of cattle.

The sustainable farms, as matching all 5 environmental and production criteria, significantly differ at regional level. This differentiation concerns all basic characteristics. The smallest differentiation was observed for labor input which seems to result from natural fluctuation range of this characteristic.

Map 7. Basic characteristics of the sustainable farms by voivodships (average per farm)



FADN macro-regions:

- I – Pomorze i Mazury
- II – Wielkopolska i Śląsk
- III – Mazowsze i Podlasie
- IV – Małopolska i Pogórze

Characteristics per farm:

- Area of agricultural land (ha)
- Labor input (JPZ)
- Livestock (SD)
- Economic size (ESU)

Now we will check which characteristics describe the farms matching particular environmental and production sustainability criteria as compared to the total of sustainable farms. At the beginning, once again we emphasize that these are disjoint sets, therefore comparisons of farms fulfilling particular criteria requires carefulness in terms of interpretation of results. It is easier to compare the total population of individual farms and population of farms matching all 5 sustainability criteria.

First, the same as before, we will refer to basic characteristics of farms highlighted against the background of sustainable farms.

Table 7. Basic characteristics of farms matching selected sustainability criteria

Item	GZŚP	Sustainability criteria				
		cereals	groups	winter crops	SD/GPP	SD/UR
Agricultural land (ha)	12,7	4,9	10,9	7,8	6,9	5,5
Labor input (JPZ)	1,5	1,0	1,6	1,1	1,0	0,9
Livestock (SD)	3,9	2,8	6,8	4,2	2,6	2,5
Economic potential (ESU)	7,5	3,9	7,0	4,7	3,0	3,2
Agricultural farms (% in group)	43	25	51	33	27	27

Let's take a closer look at usage of land in the highlighted groups of farms. First we will identify land used by these farms.

Table 8. Usage of land by individual farms (average per farm)

Item	Poland	GZŚP	Sustainability criteria				
			cereals	groups	winter crops	SD/GPP	SD/UR
Area in total (ha)	6,3	13,7	5,6	12,2	8,6	7,9	6,3
UR area (ha)	5,5	12,7	4,9	10,9	7,8	6,9	5,5
- Arable area (%)	76	87	77	81	85	71	76
including: sowings[a] (%)	95	99	95	99	98	95	95
- Permanent green areas (%)	21	12	20	18	14	27	21
- Other area[b] (%)	3	1	3	1	2	2	3
Forests and forest land (ha)	0,4	0,4	0,4	0,7	0,3	0,6	0,4

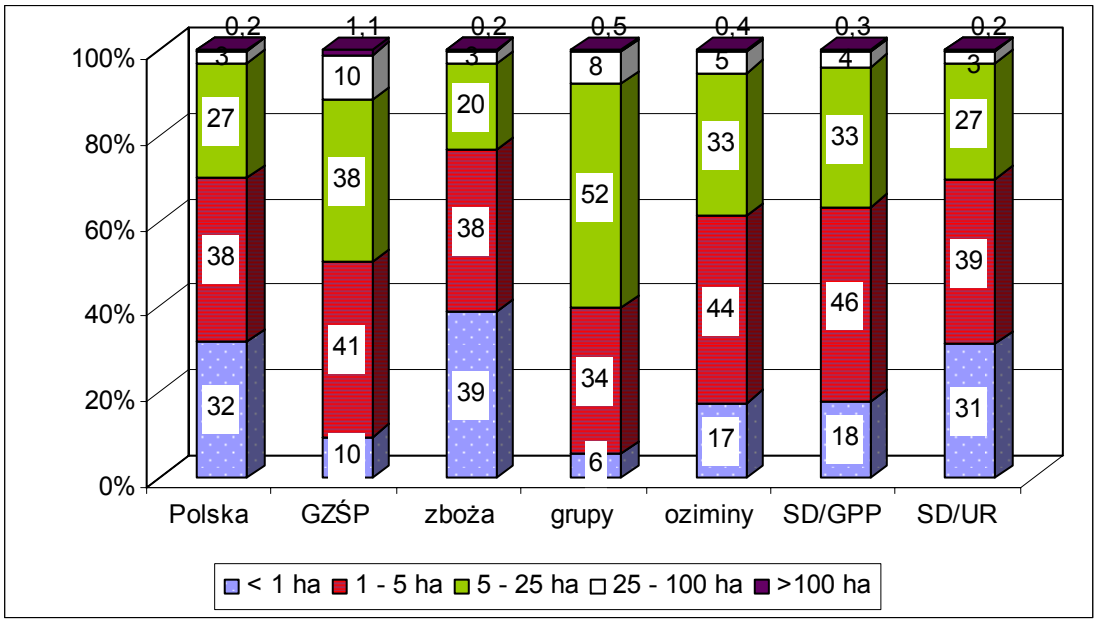
[a] as complementary to the agricultural area: agricultural fallows and set aside land (set aside land includes the arable land not harvested, which has not been cultivated for at least 2 years; agricultural fallows include areas not sown in a given year – not agriculturally useable; [b] other area includes permanent crops and allotments.

The sustainable farms (GZŚP) have twice-larger agricultural areas as compared to average individual farm, are characterized by lower share of permanent green areas, agricultural fallows and set aside land. The farms matching at least one of the environmental and production criteria significantly differed as regards land characteristics (as in table 8).

All the selected farm groups were small or very small as compared to the current standards. Particularly positive in this regard is the share of sustainable farms and farms matching the groups of plants criterion. Obviously there is also a small – smallest from all selected groups – share of farms matching the cereals criterion. On the other hand, the small area of farms matching the SD/UR criterion reflects a huge change in production processes which take place in peasant farms. It consists in withdrawal of small farms from animals rearing (growing percentage of non-inventory farms) and in concentration of animal production in the still decreasing number of farms.

The differences in terms of average are of agricultural land of selected farm groups is confirmed by their area structure. Decisive in this regard is the percentage of mini-farms, i.e. farms of the area of less than 1 ha UR.

Fig. 7. Structure of individual farms by the area of agricultural land in analyzed groups



Polska – Poland
zboża – cereals
grupy – groups
oziminy – winter crop

As regards the crop structure, as much as 1/5 of farms has no field crops. All the sustainable farms have the field crops, it does not refer however to farms

matching the criterion SD/GPP and SD/UR. All sustainable farms cultivated cereals, as compared to as less as 15% of the whole of farms. It is interesting that 43% of farms matching the cereals criterion have not cultivated cereals at all. In principal, farms with particular crops are more frequent within the groups of sustainable farms which mean that the simplification of plant production (also animal production) in this group is higher as compared to the whole of population of individual farms. It is explicitly conformed by data in table 9.

Table 9. Farms with field crops
(% of farms in group)

Item	Poland	GZŚP	Sustainability criteria				
			cereals	groups	winter crops	SD/GPP	SD/UR
Farms with crops (%) of:	80	100	100	100	100	84	81
- cereals	85	100	57	99	99	87	85
- pulses for grain	3	13	4	9	4	3	3
- potatoes	69	90	78	95	70	71	69
- sugar beets	4	26	6	10	7	5	4
- root feed plants	10	22	11	22	13	10	10
- rape and colza	3	28	5	7	7	3	3
- for green food products	20	48	30	59	17	24	20
- for ploughing	2	2	3	2	1	2	2
- spring catch crops	4	10	3	8	8	4	4
- winter catch crops	2	6	2	5	5	2	2

The group of sustainable farms was characterized by more than average percentage of farms with sugar beet crops (6-times difference), rape and colza (also 10-times difference), pulses for grain (more than 4-time difference). Additionally, more than double of sustainable farms cultivated catch crops as compared to the whole of individual farms. The reason for such significant differences in share of farms with plant production was the adopted sustainability criteria. Each farm must have been characterized by a defined percentage of cereal plants, winter plants and the number of groups of plants.

The sustainable farms did not cultivated only 1% of the area of agricultural land for plant crops. It was 5 times less as compared to the total population of individual farms.

The differences between the analyzed groups in terms of number of particular plant crops were also reflected in the sowing area. The sustainable farms were characterized by more environmental-friendly crop structure as compared to the whole of the individual farms. Additionally they were characterized by low share of cereals, i.e. only slightly more than half of the area was covered by these plants. Particularly distinguishable differences between

sustainable farms and average results were observed for rape and colza sowing (five-time difference), sugar beet (four-time difference) and pulses for grain (three-time difference). Similar was the share of sowing area of root feed plants (lower than 0,5%), crops for green area products (lower than 6-7%) and crops for ploughing (lower than 0,5%).

Table 10. Share of main crops in groups of individual farms by the sustainability criteria

Item	Poland	GZŚP	Sustainability criteria				
			cereals	groups	winter crops	SD/GPP	SD/UR
Area of sowings (%)	95	99	95	99	98	95	95
- cereals	77	54	46	69	79	77	77
- pulses for grain	0,7	2,0	1,6	1,1	0,7	0,8	0,7
- potatoes	6	4	9	6	4	5	6
- sugar beets	2	11	5	3	3	3	2
- root feed plants	0,4	0,4	0,7	0,5	0,4	0,4	0,4
- rape and colza	3	18	8	5	7	4	3
- for green food products	7	6	19	12	3	7	7
- for ploughing	0,3	0,2	0,9	0,2	0,1	0,3	0,3
- spring catch crops	1,9	3,5	2,1	2,2	3,6	1,8	1,9
- winter catch crops	1,1	2,1	1,2	1,2	2,0	1,0	1,1

Table 11. Share of main crops in groups of individual farms by the sustainability criteria at the national level (individual farms in total = 100)

Item	GZŚP	Sustainability criteria				
		cereals	groups	winter crops	SD/GPP	SD/UR
Area of sowings (%)	4	25	49	46	53	98
- cereals	3	15	44	47	53	98
- pulses for grain	12	54	78	47	61	99
- potatoes	3	40	47	35	48	99
- sugar beets	20	55	71	65	70	97
- root feed plants	4	42	61	45	52	97
- rape and colza	23	57	66	91	55	99
- for green food products	4	69	83	23	52	96
- for ploughing	2	76	25	20	53	100
- spring catch crops	8	28	57	86	48	97
- winter catch crops	8	28	55	84	47	97

The sustainable farms, having as much as 3,7% of the agricultural area and 4,3% of arable area, account for 23% of the rape and colza crop area, 20% of sugar beets crop area, 12% of pulses for grain crop area and 8% each of winter and spring catch crop area. Cereals and potatoes crops covered less percentage of

area. It is worth to emphasize the significant share of structure-forming crops – pulses and catch crops – that support anti-erosion activities. The group of farms matching the cereals share criterion, accounting for only slightly more than ¼ of the population of individual farms, had only 15% of the area of this type of plants. It demonstrates that the remaining 85% of the cereals area in Poland was owned by farms having more than 66% share of cereals in the sowing structure. The group with the said share of cereals distinguishes itself by significant area of rape and colza, crops for green fodder products and for ploughing (respectively 57, 69 and 76% share of the area under the said crops).

Farms having at least 3 groups of plants in their sowing structure accounted for more than 1/5 of the population and simultaneously had approximately 80% of sowing percentage, i.e. pulses for grain and crops for green fodder products.

Farms having at least 33% share of winter crops in sowing accounted for less than 1/3 of the population of individual farms, however had ca. 90% share of general crops, i.e. rape and colza, winter and spring catch crops. It demonstrates that farms which do not match this criterion, i.e. 2/3 of the whole of individual farms, had only slightly more than ten share of catch crops. Therefore we can assume that farms with catch crops, cultivate them at larger scale.

Almost 2/3 of individual farms held animals, in other words 1/3 of farms carried out only plant production. As regards sustainable farms, at least 90% of them held animals.

The adopted sustainability criteria stimulate the simultaneous plant and animal production. Remarkably, they do not "obligate" to animal production as only maximum livestock on agricultural land and on main fodder area was determined. The most significant differences between sustainable farms and the whole of individual farms were observed for farms holding sheep, goats and horses (i.e. 9 and 15%). The sustainable farms were characterized by highest share of farms with pig production (respectively 54 and 45%). Decisively, the largest number of farms holding pigs was in the group matching the number of groups of cultivated plants criterion (more than 60%).

Basing on the adopted sustainability criteria, one could expect that it will only refer to farms holding the ruminants, however as calculation shows, percentage of this group of farms was much lower as compared to the total of sustainable farms. These groups were characterized by similar share of farms holding cattle (respectively 59 and 51%) and poultry (respectively 89 and 85%).

Table 12. Livestock in surveyed groups of individual farms

Item	Poland	GZŚP	Sustainability criteria				
			cereals	groups	winter crops	SD/GPP	SD/UR
Farms with animals (%)	63	86	63	92	78	66	62
- cattle	51	59	50	76	52	48	51
including diary cows	93	90	94	95	92	91	93
- pigs	45	54	34	62	54	46	45
- sheep or goats or horses	15	9	13	16	11	13	14
- poultry	85	89	86	87	88	84	86
Livestock per farm[a] (SD)	2,9	3,9	2,8	6,8	4,2	2,6	2,5
- cattle	1,6	2,0	2,1	4,5	1,8	1,2	1,5
including diary cows	1,1	1,3	1,5	3,1	1,2	0,8	1,1
- pigs	0,9	1,6	0,4	1,8	1,9	1,0	0,8
- sheep or goats or horses	0,1	0,1	0,1	0,2	0,1	0,1	0,1
Livestock (SD) per 1 ha UR[b]	0,7	0,4	0,7	0,7	0,7	0,5	0,6

[a] livestock is expressed in relation to the number of individual farms. Large animals were computed according to the valid requirements of the National Agricultural and Environmental Programme of the Rural Area Development Plan in 2004-2006; [b] this relation refers only to livestock on agricultural areas for farms holding farm animals.

It is worth to remark that farms characterized by the indicated number of cultivated plants differentiated themselves by the highest percentage of farms holding animals (92%). This population was characterized by the highest share of farms in each of surveyed categories of animals. The farms matching the criterion of number of cultivated plants managed more differentiated and environment-friendly plant production, and simultaneously relatively more frequently combined the plant production with animal production.

The high percentage of farms holding pigs, i.e. 54% within the group of sustainable farms, indicate that not only farms holding animals classified as ruminants may run environmentally friendly production.

Livestock per farm fluctuated around 3 large animals (SD) at the national level, however in the group of sustainable farms it was 4 SD. Even more value was observed for the group of farms matching the criterion of groups of cultivated plants (livestock amounted to almost 7 SD and was simultaneously twice larger as compared to the group of sustainable farms). The same relation also manifested in case of cattle, sheep, goats and horses.

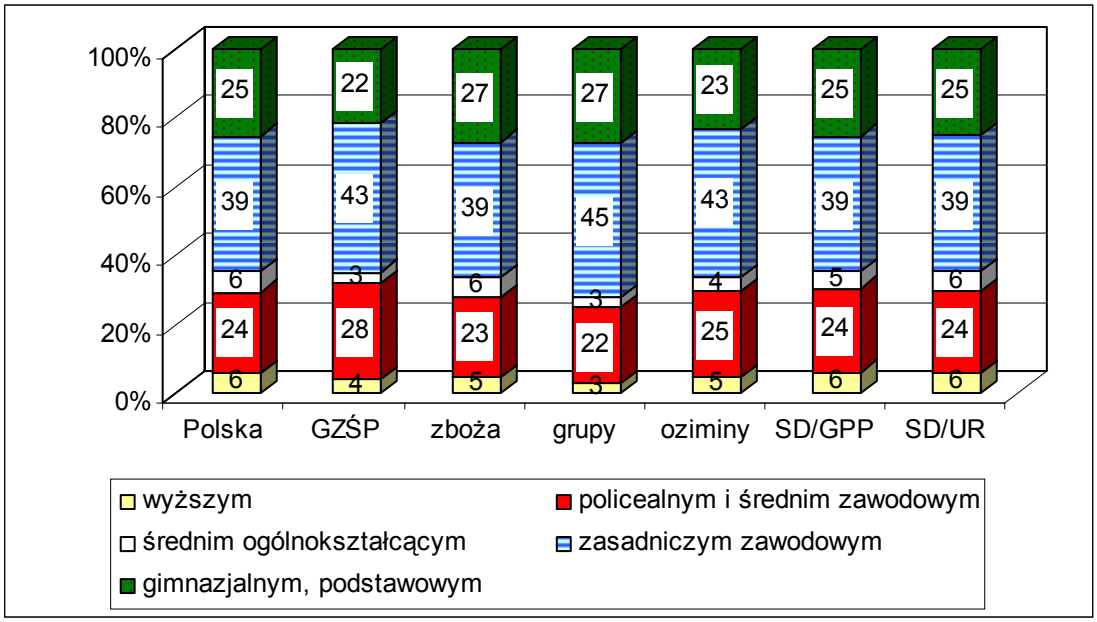
The livestock of animals on the area of agricultural land was almost twice lower as compared to average results for all sustainable farms. As regards farms which fulfill at least one of 5 sustainability criteria, the livestock fluctuated between 0,5 and 0,7 SD/UR.

The labor input in average individual farm has not exceeded 1 JPZ. As regards the group of sustainable farms, the labor inputs were 60% higher (1,5 JPZ). Similar value characterized farms matching the criterion of groups of cultivated plants.

In principle, structures of labor input were very similar: in each of surveyed population own work prevailed and the contract work, in particular permanent contract work, accounted for only a marginal percentage. Sustainable farms used it to larger extent.

The structure of individuals managing the farm[25] by education level was presented in fig. 8.

Fig 8. Structure of individuals managing the farm by their education level



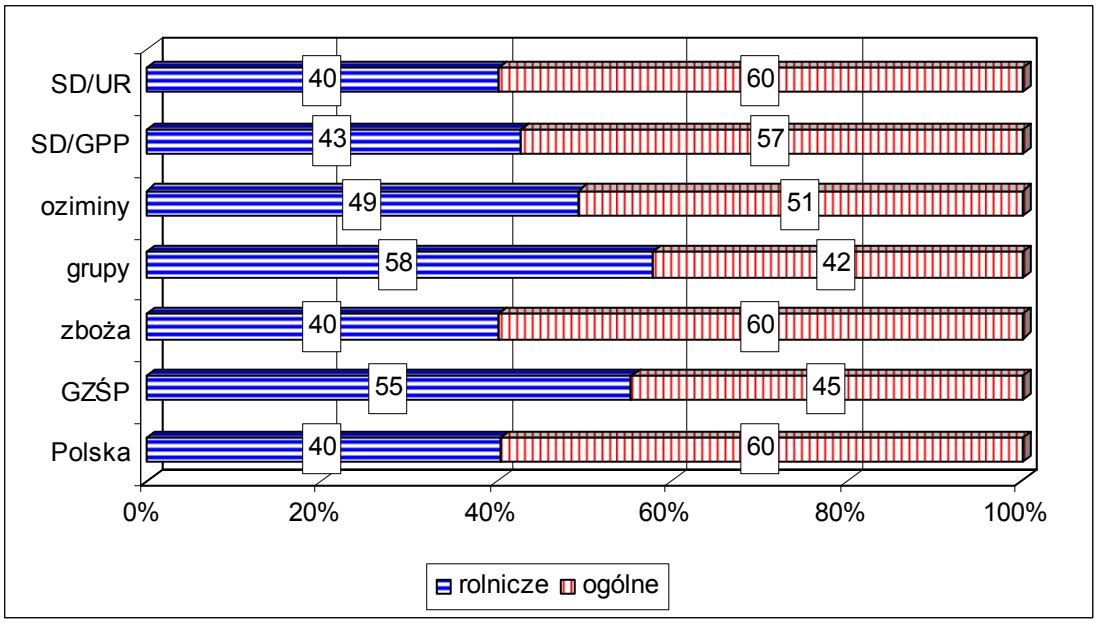
wyższym – higher
średnim ogólnokształcącym – secondary general
gimnazjalnym podstawowym – gymnasium, elementary
policealnym i średnim zawodowym – secondary and secondary vocational
zasadniczym zawodowym – elementary vocational

The structure of separated groups was very similar as regards sustainable farms. Each population was dominated by farms managed by persons with basic vocational education (39-45%), secondary and secondary vocational education (22-28%) and basic gymnasium education (22-27%).

Remarkable is the share of farm managers with agricultural education (fig. 9).

[25] „Person managing the agricultural farm is an individual authorized by owner/user of the agricultural holding to make decisions directly connected with production processes, supervision and realizing them. Usually, not always however, the manager is the same person as the user". See *Charakterystyka gospodarstw rolnych w 2005 r. (Characteristics of Farms in 2005),* GUS, Warszawa 2006.

Fig 9. Structure of individuals managing the farm by type of education



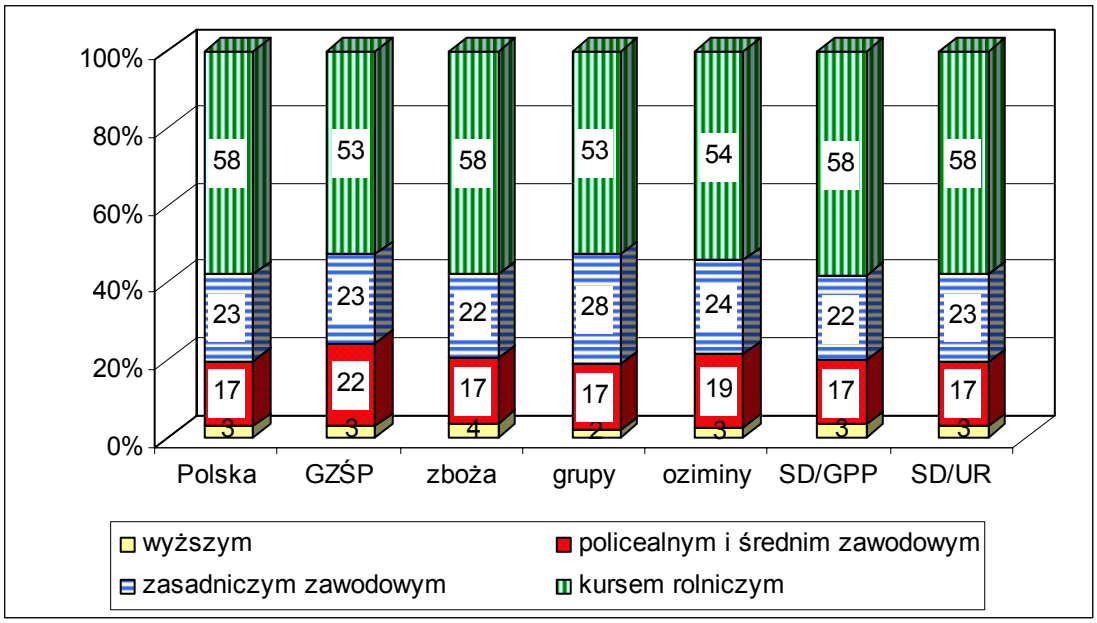
rolnicze – agricultural
ogólne - general

The sustainable farms distinguished themselves by 15 p.p. higher share of persons with agricultural education as compared to the national average of individual farms (i.e. 40% in Poland, 55% in the group of sustainable farms). Also in groups of farms matching at least one sustainability criterion, the share of persons with agricultural education was relatively higher. In particular, group of farms matching the criterion of groups of cultivated plants distinguished itself by the highest share of individuals with higher education (58%). The results manifest that farmers with professional training are more open towards proecological farming and more frequently show an active attitude[26].

Structure of agricultural education, the same as education in total, was recognized as very similar (fig. 10). In the group of persons with agricultural education, most of them completed agricultural courses (53-58%).

[26] See W. Wilk, *Zrównoważone gospodarowanie a aktywność rolników (Sustainable farming and Famers' Activity),* [in:] *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu (Scientific Yearbook of the Community of Agriculture and Agrobusiness Economists)*, Warszawa − Poznań 2007, in print.

Fig. 10. Structure of farm managers by agricultural education level



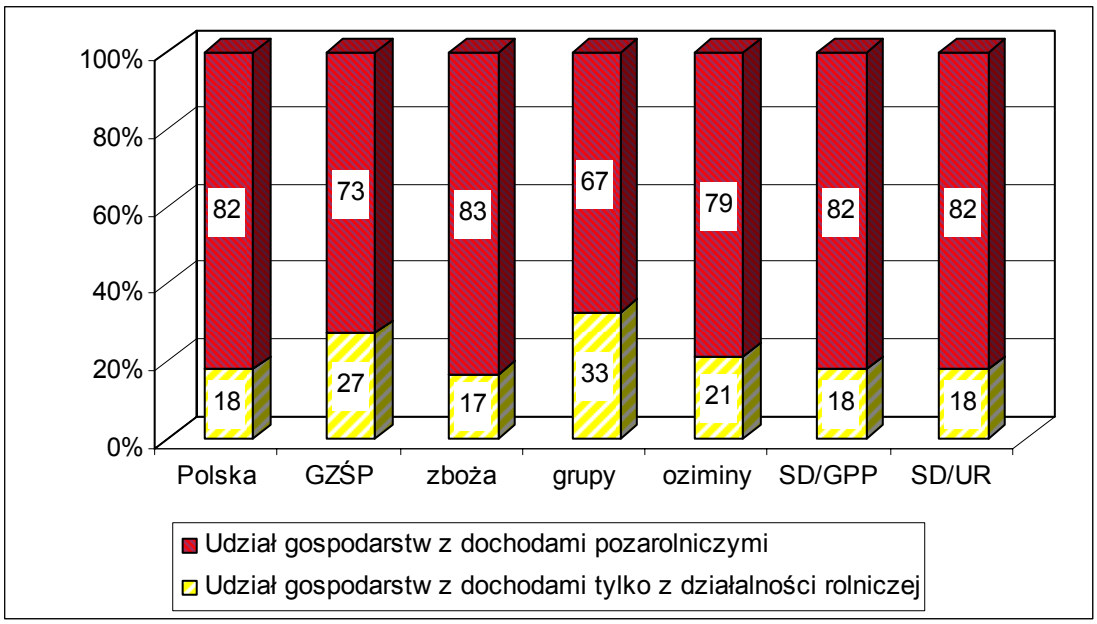
Polska – Poland
zboża – cereals
grupy – groups
oziminy – winter crops
wyższym – higher
zasadniczym zawodowym – elementary vocational
policealnym i średnim zawodowym – secondary and secondary vocational
kursem rolniczym – agricultural course

Sustainable farms use incomes from non-agricultural sources less frequently – most frequently it refers to farms matching the criterion of groups of plants in crop rotation, least often to farms matching the criterion of cereals. Therefore we can conclude that sustainable farms obtain more profitable and satisfactory incomes from agricultural activity and this is the reason for not undertaking any non-agricultural activities.

As regards non-agricultural incomes in sustainable farms, they are dominated by pensions, disability payments and contract work. Every second farm obtained income from contract work and pensions and disability payments.

The structure of farms by predominant income from different agricultural and non-agricultural household activities was similar as compared to the sustainable farms (tab.11). However, the most comparable as regards the sustainable farms is the structure of farms matching the criterion of groups of cultivated plants.

Fig. 11 Structure of surveyed groups of farms by agricultural and non-agricultural sources of income



Polska – Poland
zboża – cereals
grupy – groups
oziminy – winter crops
udział gospodarstw z dochodami pozarolniczymi – share of farms with non-agricultural incomes
udział gospodarstw z dochodami tylko z działalności rolniczej – share of farms with incomes only from agricultural activity

Table 11. Share of farms with incomes from non-agricultural activities in surveyed groups of farms

Item	Poland	GZŚP	Sustainability criteria				
			cereals	groups	winter crops	SD/GPP	SD/UR
Farms with incomes from non-agricultural activities	82	73	83	67	79	82	82
- non-agricultural activity[a]	10	10	10	9	11	11	10
- contract work	51	53	49	51	53	52	51
- pensions and disability payments	52	60	56	59	54	51	52
- other unearned sources[b]	5	5	6	6	5	6	5

[a] the following incomes are qualified as non-agricultural incomes by GUS: services with the use of own equipment, agro-tourism, room rental and other rental, processing of agricultural products, processing of wood, handicraft, aquaculture, generation of renewable energy for the market, other activities (including rearing of furring animals);
[b] the following incomes are qualified as other unearned incomes by GUS: social benefits, educational benefits, alimony, scholarships, international aid, game of chance revenues, wins at lotteries, etc. as well as incomes from capital deposits.

Information on predominant income, i.e. exceeding 50% of incomes of households from different sources, allows to estimate which source of income is the most significant for the surveyed groups of farms. The presented share of farms with predominant income in each of groups at the level of 100% shows that each of surveyed farms obtained an income from a defined activity at the minimum level of 50%[27]. This is positive as it demonstrates that the structure of incomes is not dispersed.

Table 12. Structure of farms by predominant income in the total income of household in surveyed groups of farms

Item	Poland	GZŚP	Sustainability criteria				
			cereals	groups	winter crops	SD/GPP	SD/UR
Total farms with predominant income [a] from:	100	100	100	100	100	100	100
- agricultural activity	27	43	25	51	33	27	27
- agricultural activity and contract work	0,8	1,0	0,7	1,6	1,1	0,9	0,8
- contract work	30	20	29	16	27	30	30
- contract work and agricultural activity	3	5	3	4	3	3	3
- non-agricultural activity	5	2	5	2	4	5	5
- pensions and disability payments	27	20	31	15	22	25	27
- other unearned sources	1,5	0,2	1,6	0,7	1,0	1,5	1,5
- other	7	9	6	9	8	7	7

[a] farms qualified to the mentioned groups has shown the income from given activity at the minimum level of 50% of joint incomes of the household.

In spite of moderate similarity of structure between sustainable farms and the whole of individual farms, significant differences in terms of share of farms of predominant income from agricultural activity were observed. In average, every fourth farm obtained the predominant income from agricultural activity. Sustainable farms differentiated themselves by 16 p.p. higher percentage of farms with predominant income from agricultural activity as compared to the results of all individual farms (respectively 27 and 43%).

[27] As predominant sources of income GUS enumerates: agricultural activity and contract work, as well as contract work and agricultural activity. The difference between these two sources consists of predominant share of income from agricultural activity or from contract work, e.g. predominant source of income from agricultural activity and contract work includes farms with income from agricultural activity higher as compared to the income from contract work and, simultaneously, with their total sum at least 50% of the total income of household.

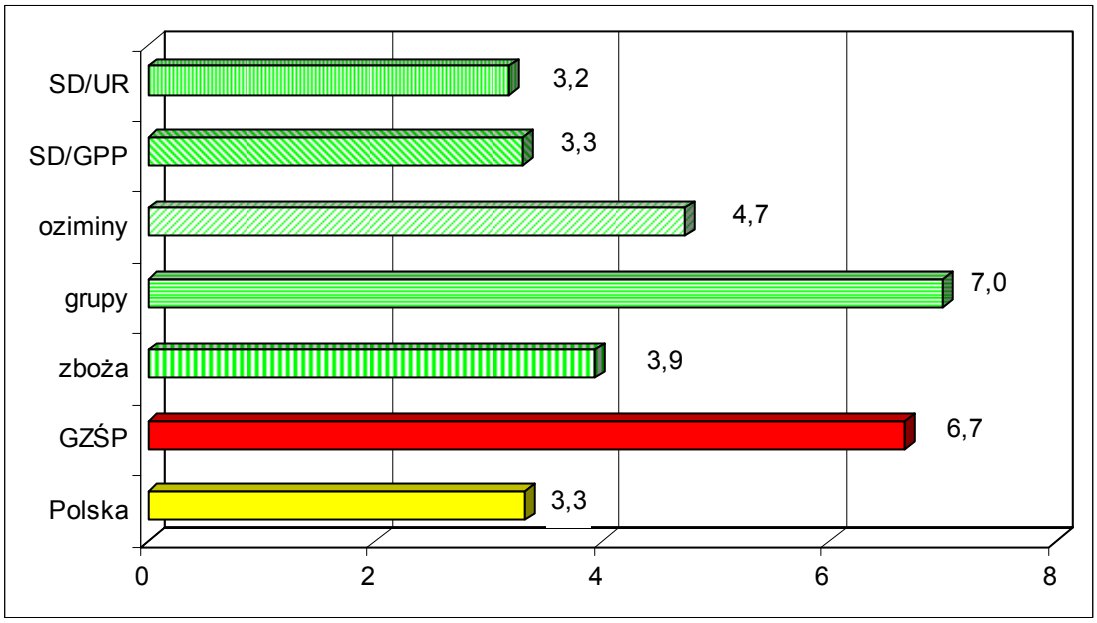
Another important source of income is the contract work. The sustainable farms were characterized by 10 p.p. lower share in this group of farms (20% for the population) as compared to the national average (30% of the population). Also pensions and disability payments played an important role in the income structure. Every fifth sustainable farm distinguished itself by their predominance (and every fourth in average at national level).

Farms with predominant source of income from contract work and agricultural activity accounted for significantly smaller part of the population of surveyed groups. Non-agricultural activity and other activities accounted for less than 10%.

The share of farms with predominant source of income from agricultural activity and contract work, as well as other unearned sources, was the lowest for each of surveyed groups as compared to other sources of income.

Farmers maintaining the sustainable farms are more frequently interested in agricultural activity, non-agricultural activities are of less importance. This approach translates into higher economic strength[28] (fig. 12).

Fig. 12. Economic size of surveyed groups of farms (expressed in ESU[a] per farm)

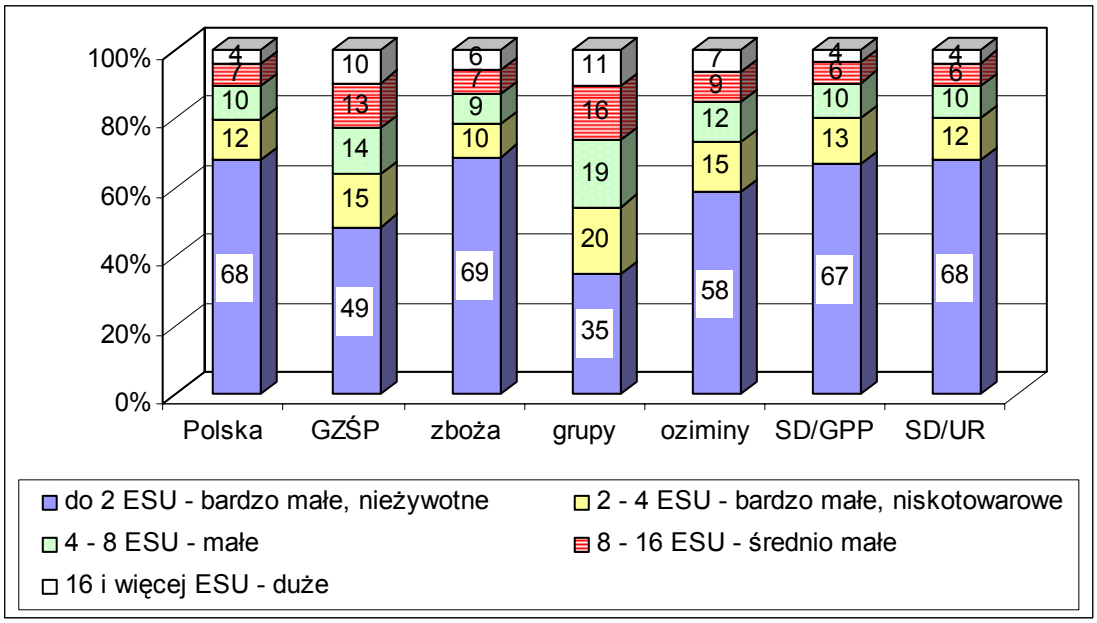


[a] The economic size of the agricultural farm is the sum of direct standard gross margins of all activities in the farm. The economic size is expressed in European Size Units. From 1984 this value has been 1 200 euro.

[28] See W. Wilk, *Zrównoważone gospodarowanie a aktywność rolników (Sustainable Farms and ctivity of Farmers),* [in:] *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu (Scientific Yearbook of the Community of Agriculture and Agrobusiness Economists)*, Warszawa − Poznań 2007, in print.

The economic size of all individual farms was slightly higher than 3 ESU and at the same time was lower by half as regards sustainable farms. Remarkably, farms cultivating at least 3 groups of plants differentiated themselves by the higher economic strength, i.e. at the level of 7 ESU. The analysis of farm structure by economic size in surveyed groups allows further examination of this issue (fig. 13). This division is identical as the classification method by economic size adopted by FADN (system of collection and use of accounting data from farms)[29].

Fig. 13. Structure of surveyed farm groups by their economic size



Polska – Poland
zboża – cereals
grupy – groups
oziminy – winter crops
do 2 ESU – bardzo małe, nieżywotne – up to 2 ESU, very small, non-viable
2 – 4 ESU – bardzo małe, niskotowarowe – 2 – 4 ESU, very small, subsistence
4 – 8 ESU – małe – 4 – 8 ESU – small
8 – 16 ESU średnio małe – 8 – 16 ESU average small
16 i więcej ESU – duże – 16 ESU and more – large

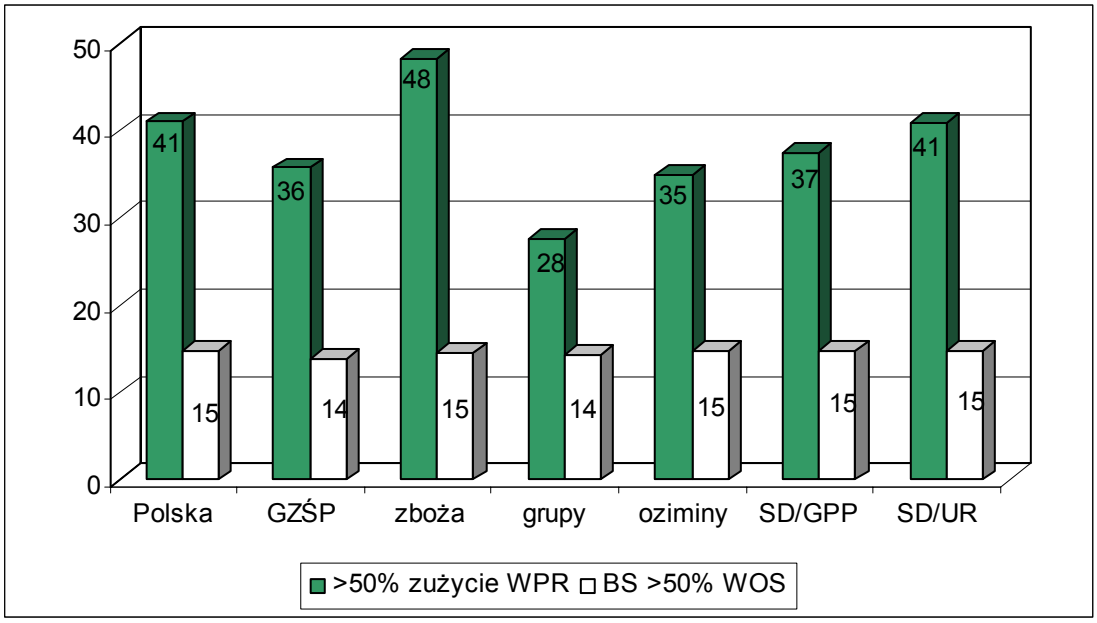
As the fig. 13 shows, the most significant differences are observed for non-viable farms, very small farms of the economic strength lower than 2 ESU as well as in case of large farms – of the size of at least 16 ESU. The sustainable farms were characterized by much lower percentage of non-viable farms (lower of more than a quarter) as compared to the total of individual farms. Simultaneously the

[29] See *Metodyka liczenia nadwyżki bezpośredniej i zasady typologii gospodarstw rolniczych (Methodology of Computing the Standard Gross Margin and Principles of Farms Typology),* I. Augustyńska-Grzymek, FAPA, Warszawa 2000.

sustainable farms were characterized by more than twice higher share of large farms and average small as compared to the total population (more than twice higher). The farms matching the criterion of the number of groups of cultivated plants and winter crops were characterized by very similar structure to sustainable farms. These two sustainability criteria had most significant influence on the average economic strength of the sustainable farms.

The income statistics also separate households of users which use more than 50% of the production value generated by the farm. Such information allows to partly control the production intended for subsistence of farm and sales of surpluses to the market (fig. 14).

Fig. 14. Share of farms by the use of production for own needs[a] and value of direct sales[b]



Polska – Poland
zboża – cereals
grupy – groups
oziminy – winter crops
>50% zużycie WPR - >50% WPR use

[a] symbol „>50% WPR use" means households of users which use more than 50% of the agricultural production of farm; [b] symbol „BS > 50% WOS" means farms where the direct sales for consumers is at the level higher than 50% of the total sales of the farm

The percentage of subsistence farms exceeds 40% of the total of individual farms. Slightly lower percentage in this group was observed for sustainable farms (of 5 p.p.). It means that smaller part of farms with environmental-friendly production uses at least half of the production value generated by the farm, therefore simultaneously more farmers produce for the market.

The share of farms with the direct consumer sales higher than 50% of the total sales of farm, remained stable in particular groups. One can guess that sustainability of farming has no impact on activities taken up by farmers in terms of consumer direct sales.

6. Sustainability of agricultural households

Under the GUS research, the basic criterion to identify social and economic groups (types) of households is their income. In general, income from one source exceeds 50%, which is used as a threshold value of fulfilling the criterion. In certain cases however, this criterion is fulfilled by joint income from two or even more sources. Depending on it, farms are allocated to one of seven social and economic groups. The eighth group includes other households.

The population of households of individual farmers (individual users of agricultural farms) is strongly differentiated in terms of predominant source of their income. The agricultural farm is the source of income for smaller number of families (households) as compared to the contract work and slightly smaller as compared to social benefits. Respectively it accounts for 27, 30 and 27%. In case of other families, the main source of income is non-agricultural activity for own account (4,8%), contract work and agricultural activity (3,6%), other unearned sources apart from pensions and disability payments. In case of 6,5% of households, the income is composed of more than two sources or it was impossible to determine the source of income.[30]

In this work we focus on agricultural farms, which means households, including a user of farm, for which the income from agricultural farm accounts for more than 50% as compared to the total of all sources of income. These households – of agricultural type – are the core of the individual agriculture. It also reflects in types of means of production used, economic size (economic strength) and much stronger connection with place of work and living as compared to other social and economic groups. Prevailing in this regard is the land, livestock and economic size. The agricultural farms account for approximately 2/3 of the agricultural area, half of labor input (JPZ) and 78% of livestock (SD) of the whole of the individual agriculture. Farms in this economic and social group stand out from others not only by absolute values per average farm. In this work we do not intend to analyze differences between social and economic groups of farms. We will only focus on clear-cut differences in terms of agricultural area, labor input, livestock and economic strength. Comparable to

[30] Another divisions of households by source of income are discussed in detail in: J.St. Zegar, *Źródła utrzymania rodzin związanych z rolnictwem (Sources of Income of Agricultural Families),* Studia i Monografie, book 133, IERiGŻ-PIB, Warszawa 2006.

agricultural farms to some extent are households of group II – formerly called peasant-working households (contrary to group IV – working-peasant households). Other household groups clearly differ in terms of production resources (tab. 13) and efficiency indexes (tab. 14).

Table 13. Selected data on farms by predominant source of income (per farm)

Item	I	II	III	IV	V	VI	VII	VIII
Area in total (ha)	14,53	8,75	2,96	4,58	5,13	2,23	3,03	6,72
Agricultural land (ha)	13,15	7,62	2,42	3,67	4,24	1,75	2,43	5,80
Arable land (ha)	10,38	5,64	1,71	2,64	2,98	1,19	1,56	4,31
Labor input (JPZ)	1,68	1,67	0,52	1,10	0,52	0,55	0,47	1,22
- of the family	1,57	1,64	0,50	1,08	0,48	0,54	0,45	1,19
Working in farm (persons)	2,33	3,16	1,94	2,74	1,90	1,71	1,63	2,46
Working persons $\geq$ 65 years (%)	14,53	8,75	2,96	4,58	5,13	2,23	3,03	6,72
- users (%)	13,15	7,62	2,42	3,67	4,24	1,75	2,43	5,80
Users with higher education (%)	2,2	4,0	10,1	5,4	10,8	3,0	7,9	3,9
- higher agricultural (%)	1,2	1,7	1,6	0,8	2,3	0,5	1,2	1,2
Users with agricultural education (%)	59,5	52,7	27,7	36,6	35,5	28,8	27,6	44,4
Users – M, (%)	81,4	66,5	65,8	60,0	75,9	55,0	62,1	69,2
Users – F, (%)	18,6	33,5	34,2	40,0	24,1	45,0	37,9	30,8
Working persons/JPZ	1,33	1,92	3,84	2,54	3,09	3,17	3,63	2,07
Livestock (SD)	8,48	4,05	0,62	1,61	1,00	0,54	0,51	2,78
Economic strength (ESU)	8,96	4,2	1,07	1,82	1,81	0,74	0,91	3,28

Legend – predominant source of income from: I – agricultural farm, II – from agricultural farm and contract work, III – from contract work, IV – from contract work and agricultural farm, V – from off-farm activity on own account, VI – from pensions and disability payments, VII – from other unearned income, VIII – other farms.

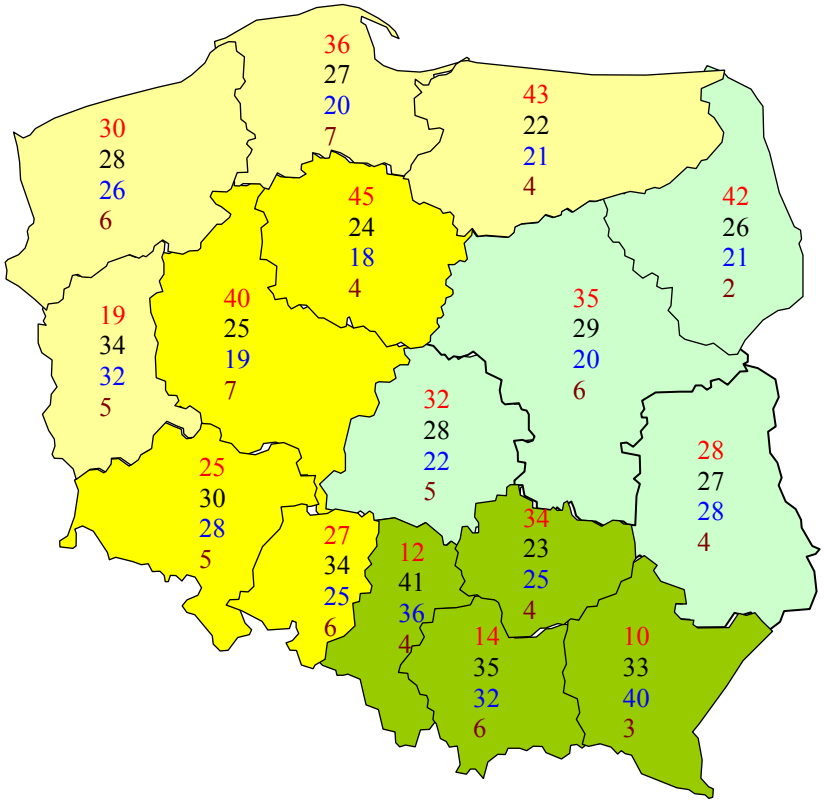
Table 14. Selected farm efficiency indexes by social and economic groups

Item	I	II	III	IV	V	VI	VII	VIII
ESU/ha UR	0,68	0,55	0,44	0,50	0,43	0,42	0,37	0,57
ESU/JPZ	5,33	2,51	2,07	1,66	3,49	1,34	1,95	2,68
JPZ/100 ha UR	12,8	22,0	21,4	29,9	12,2	31,5	19,2	21,1
SD/1 ha UR	0,64	0,53	0,26	0,44	0,23	0,31	0,21	0,48
Users $\geq$ 65 years (%)	5,1	10,4	2,5	15,1	2,1	49,8	4,5	12,7
Users with agricultural education (%)	59,5	52,7	27,7	36,6	35,5	28,8	27,6	44,4

Legend: as in table 13

The percentage of agricultural farms and other social and economic groups shows significant spatial differentiation (map 8). Relatively the largest number of agricultural farms (more than 40%) is concentrated in voivodships with leading role (Wielkopolskie and Kujawsko-Pomorskie) or with significant importance (Warminsko-Mazurskie and Podlaskie) of agriculture in the region's economy. The smallest number of agricultural farms (less than 20%) is concentrated in regions with dispersed agriculture, high frequency of use of contract work and social payments (podkarpackie, śląskie, małopolskie, lubuskie).

Map 8. Percent of agricultural holdings, contract workers, pensioners and business in particular voivodships by FADN macro-regions



FADN macro-regions:

I – Pomorze i Mazury
II – Wielkopolska i Śląsk
III – Mazowsze i Podlasie
IV – Małopolska i Pogórze

Social and economic groups (%)

Agricultural households
Households of contract workers
Households of pensionners
Business households

Additionally it is worth to notice that farmers with higher education, both general and agricultural, are relatively less frequent in the group of agricultural households (2,2% with higher education, including 1,2% with agricultural) as compared to contract work households (respectively 10,1 and 1,6%) and non-agricultural business households (respectively 10,8 and 2,3%). Probably it is due to the fact that individuals with higher education have more needs and more possibilities to find competitive work as compared to work offered by household or to take up business activity on their own account. These dependencies are clear, however more difficult to understand is relatively high share of users with higher education in the group of households with unearned incomes other than pension and disability payments (7,9%).

Agricultural farms account for approximately 27% of the total of individual farms. This share increases together with the increase of the farm area. In case of the smallest farms, agriculture is the main source of income for merely 6% of farms. In the highest area group this share is close to 90%. It means that even there, for every tenth farm the main source of income is of non-agricultural nature. Share of sustainable farms is higher among agricultural farms as compared to the total of individual farms. However, 57% of sustainable farms has prevailing, non-agricultural source of income. Clearly visible is the dependency between the farm area and percentage of agricultural holdings. The larger farm area, the more often a farm becomes the main source of income for families using it. This dependency is also observed for sustainable farms (tab.15).

Table 15. Frequency of agricultural households matching the sustainability criteria against the background of the total of individual farms (%[a])

Item	Agricultural in total	Sustainable	Criterion				
			cereals	groups	winter crops	SD/GPP	SD/UR
Total	26,9	43,0	24,6	51,4	33,2	27,3	26,8
<1 ha	5,9	8,0	4,4	3,3	3,4	4,8	5,8
1-5	15,4	13,2	15,7	19,5	15,2	11,9	15,1
5-25	61,1	68,9	69,3	70,8	63,1	53,7	60,6
25-50	89,7	92,1	92,6	94,5	89,8	86,7	89,5
More than 50 ha	89,7	94,8	92,4	95,4	92,4	88,3	89,6

[a] percent was computed for groups of households fulfilling selected criteria (agricultural households and total of individual households)

It is reflected in the area structure of the groups of agricultural farms which, in case of sustainable farms, is significantly different as compared to agricultural farms, and the more to the area structure of the total of farms.

Remarkably, there is a relatively high share of the highest area group within the group of sustainable farms – 3,5 times higher as compared to the agricultural households and 11,6 higher as compared to the total of farms (fig. 15). It confirms the supposition that sustainability of farms under the selected criteria requires larger natural potential. Therefore we can say that it is the combination that clearly and synthetically reflects the situation of individual agriculture. This combination is based on the following dependency:

$$\textit{Sustainable agricultural farms} \Rightarrow \textit{agricultural farms}$$
$$(\Rightarrow \textit{sustainable farms}) \Rightarrow \textit{farms in total}$$

This combination is true for 3 basic characteristics of agricultural farms. There is one exception as regards the area of agricultural land. In case of agricultural farms, this area is slightly lower as compared to sustainable farms.

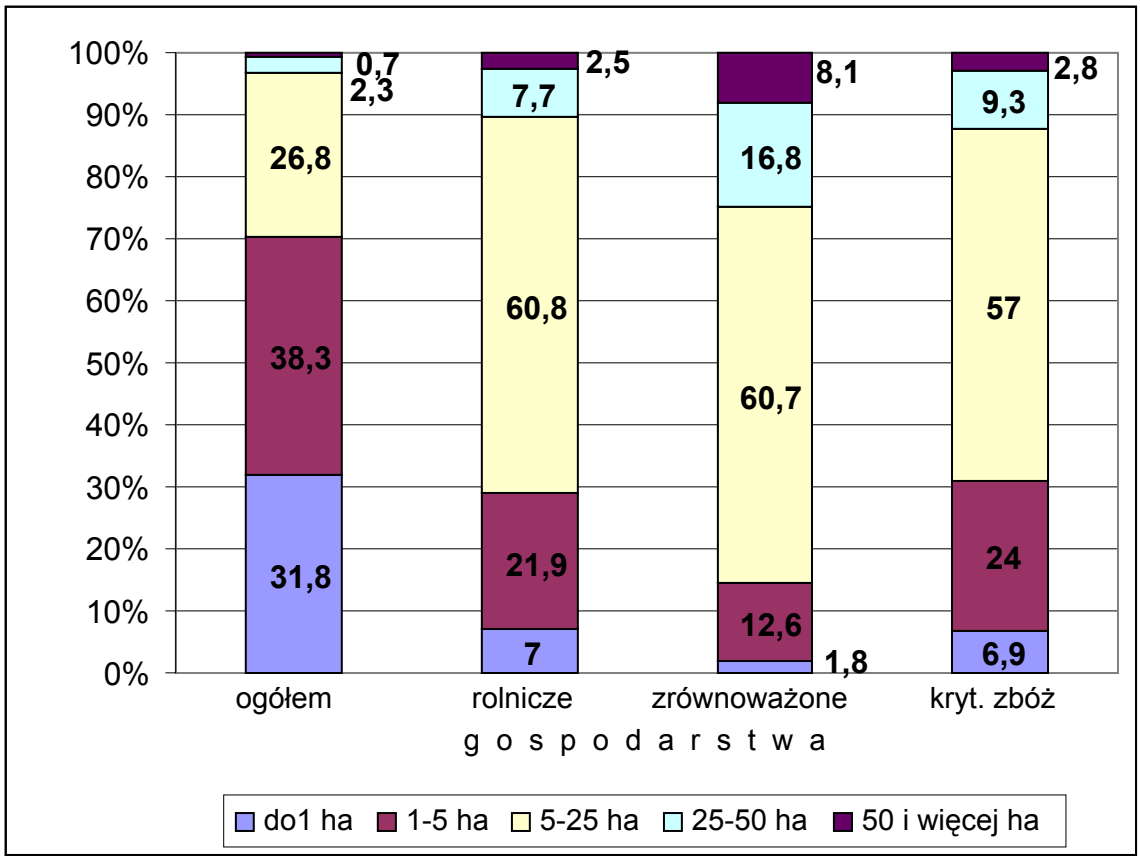
Table 16. Values of basic characteristics for selected types of agricultural farms

Item	Total	Sustainable	Agricultural	Agricultural sustainable
Agricultural area (ha)	5,5	14,1	13,2	23,8
Economic strength (ESU)	3,3	7,5	9,0	13,0
Labor input (JZP)	0,91	1,58	1,68	1,97
Livestock (SD)	2,9	4,1	8,5	7,5

The sustainable farms could be recognized as the upper class of the individual farming, if only they adopted other criteria of good agricultural practices, in particular the fertilizers balance. Even without this however, the advantage of sustainable farms being the main source of income for families is clearly visible. These farms account for only 2,6% of the whole of agricultural farms (i.e. 17,2 thousand per 664,2 thousand). However, they account for 4,7% of agricultural areas, 3,0% of labor input (JPZ), 2,3% of livestock (SD) and 3,8% of economic strength (ESU) as compared to the whole of agricultural farms. Therefore it is easy to notice that the production intensity, in particular in terms of animal production, is lower.

As regards the agricultural farms, the cereals, winter crops, groups of plants, SD/GPP and SD/UR criteria are matched respectively by 25%, 35%, 43%, 46% and 97% of farms. Interesting is the group of farms not matching the last criterion. One can judge that this is a group specialized in animal production where breeding is mostly based on purchased fodders and which threatens the environment due to surplus of organic fertilizers from faeces. This group accounts for 2,9% of all agricultural farms. It accounts for 2,5% of agricultural area, 3,5% of labor input (JZP), 16,5% of livestock (SD) and 7,8% of economic strength (ESU).

Fig. 15. Area structure of farms in total, agricultural farms, sustainable farms and farms matching the criterion of cereals share

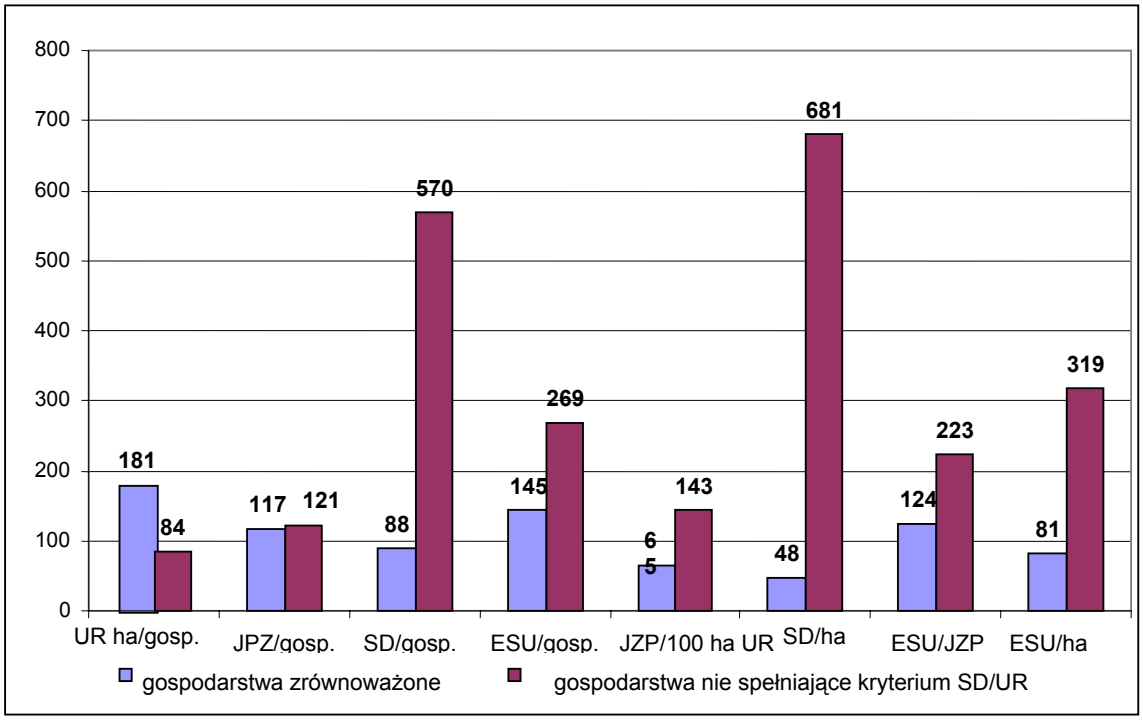


gopodarstwa - farms
ogółem – in total
rolnicze – agricultural
zrównoważone – sustainable
kryt.zbóż – cereals criterion
do 1 ha – up to 1 ha
50 i więcej – 50 and more

Fig. 16 demonstrates very precisely the difference between farms not matching the SD/UR criterion and sustainable farms and the whole of the agricultural farms. As it should have been expected, particularly it refers to livestock per farm and per 1 ha UR. In the group of farms not matching the SD/UR criterion, the livestock is 5,7 times higher as compared to the whole of agricultural farms (as regards the sustainable farms, it is 12% lower). The said livestock per 1 ha UR is, respectively, 6,8% times higher and 2 times lower. While in agricultural farms the said livestock per 1 ha UR amounts to 0,64 SD and in the agricultural farms 0,31 SD, in the group of farms not matching the SD/UR criterion it amounts to as many as 4,36 SD. In this group of farms, the standard was exceeded more than twice as permitted by the Nitrate Directive.

Fig. 16 also shows the dominance of farms not matching the SD/UR criterion over the whole of agricultural farms, 2,2 times higher for ESU/JPZ and 3,2 times higher for ESU/ha UR. Similar dominance was also observed towards the sustainable farms. The economic size per labor input unit (ESU/JPZ) is 5,3 in the group of agricultural farms, 6,6 in the group of sustainable farms – in the group of farms not matching the SD/UR criterion it amount to 11,9. The economic strength index (ESU/ha UR) amounts to respectively: 0,7; 0,5 and 2.2.

Fig. 16. Sustainable agricultural farms and farms not matching the SD/UR criterion against the background of the whole of agricultural areas (agricultural farms = 100)



UR ha/gosp. – UR ha/farm
JPZ/gosp. – JPZ/farm
SD/gosp. – SD/farm
ESU/gosp. – ESU/farm
gospodarstwa zróżwnoważone – sustainable farms
gospodarstwa nie spełniające kryterium SD/UR – farms which do not match the SD/UR criterion

6. Summary and conclusions

This study contains the analysis of sustainability of the individual agriculture in the context of frequency (percentage), significance and basic attributes of agricultural farms selected by certain characteristics. The farms were segregated into the following groups: sustainable farms, farms using the Norfolk crop rotation, non-inventory farms and subsistence farms. Selection criterion for determining the sustainable farms was matching all 5 agricultural and environmental criteria: share of cereals and winter crops in sowing structure,

groups of cultivated plants, livestock of ruminants on main fodder area and livestock of farm animals on agricultural land. Moreover, the group of agricultural farms was separated, i.e. being the main (>50%) source of income for families, which matches the environmental and production sustainability criteria. The selected environmental and production sustainability criteria are obviously not sufficient to fully evaluate the sustainability of agriculture and farms. However, they provide a general view in this field.

The study defines – at national and regional level – number of farms in selected groups, their significance for the whole of the individual agriculture as well as values of their basic characteristics. The analysis did not focus on clarifying reasons for regional differentiation of frequency or values of characteristics of determined groups of farms. It was only meant to make a picture of the current state. This issue needs further investigation. The frequency of subsistence and non-inventory farms is high – they account for, respectively 41 and 37% of the total of individual farms, similarly as the frequency of farms matching particular environmental and production sustainability criteria. The frequency of sustainable farms, farms using the Norfolk crop rotation and sustainable agricultural farms is substantially small, namely it amounts to, respectively (thousand): 51,6, 41,6 and 17,2. The analysis provides large amount of empirical material in terms of production, economic, social and environmental significance of selected groups of farms as well as values of basic characteristics of farms in these groups.

There is a relatively small number of sustainable farms which match all five environmental and agricultural sustainability criteria. These farms are characterized by twice larger area as compared to the whole of the individual farms (respectively 14 and 6 ha). Moreover this area is used in a more profitable way. The percentage of agricultural fallows and set aside land in this group was five times lower as compared to the whole of the individual farms (respectively 1 and 5%). The first also allocated the larger part of their agricultural land to cultivation of plants o arable land (respectively 87 and 76%).

The sustainable farms were characterized by much higher labor input a compared to the whole of farms (respectively 1,5 JPZ and 0,9 JPZ). The level of general education of sustainable farms managers has not significantly differed from the whole of users of individual farms. As regards the sustainable farms, the percentage of managers with agricultural education was much higher as compared to the whole of individual farms (respectively 55% and 40%).

Differences as regards the area of agricultural land between sustainable farms and the whole of individual farms substantially prejudiced the difference in their average economic strength. Relevant indexes amounted to 7 and 3 ESU. In

the selected group the share of non-viable farms (up to 2 ESU) amounted to less than 50%, while for the whole of the individual farms it was 70%. The share of average-small farms (economic strength of 8-16 ESU) amounted to, respectively 13 and 7%. The share of larger farms (economic strength at least 16 ESU) amounted to, respectively 10 and 4%.

73% of sustainable farms obtained their income from off-farm activities. It was 9 p.p. less as compared to average results of the individual farms. Apparently, sustainable farms obtain higher and more satisfactory farm incomes and this is the reason for not taking up other off-farm activities.

Information on predominant income allowed to estimate which source of income was the most significant for the analyzed farms. In each farm at least 50% of income was generated by a particular activity (such as: farming, farming and contract work, contract work and farming, off-farm activity, pensions and disability payments, other sources, others). It proves the predominant significance of source of income groups at the farm level. Basing on the above it has been stated that pension disability payments incomes, other unearned incomes and contract work incomes are of less importance as regards sustainable farming. As regards he sustainable farms, the agricultural activity was of greater importance as compared to the average individual farm. It was reflected in the share of farms with predominant income from this activity (respectively 43 and 27%).

Basing on the results of use of agricultural production value by the household users and the results concerning the direct consumer sales value, it has been stated that these two production-related categories had no impact on environment-friendly activities of farmers.

The percentage of individual farms matching at least 1 of surveyed sustainability criteria (among such as: cereals share, winter crops share, number of species of cultivated plants, livestock on main fodder area and livestock on agricultural area), may be recognized as considerable (it was within the range of 20% for group of plants criterion and 97% for livestock on agricultural land criterion). Therefore we can conclude that the difficulty to fulfill particular sustainability criteria is differentiated. However, it is difficult to draw any explicit conclusions. For example, the criterion of livestock of all animals in the farm on area of agricultural land is matched by almost all farms. It demonstrates conformity with the EU Nitrate Directive. However, non-conformity with this criterion by 2,9% of farms holding 15% of livestock (SD) may turn out to be harmful for the environment at the local level.

Almost every fifth farm matching the criterion of livestock on main fodder area and/or on area of agricultural land have not cultivated plants. It

means that it is possible to meet the sustainable criteria without farming on arable land. However, basing on sustainable agriculture principles, it is important to mix the plant production and animal production. Other requirements of sustainable farming obligate to plant cultivation. Within the group of sustainable farms, each farm held crops, i.e. carried out farming activities on arable land.

The crop structure of sustainability farms can be considered as more profitable as compared to the whole of individual farms in Poland. The sustainable farms had lower percentage of area with cereals, however larger share of winter crops, catch crops, industrial plants and specialist root crops which resulted from adopted sustainability criteria.

The adopted sustainability criteria stimulate the simultaneous plant and animal production. Remarkably, they do not "obligate" to animal production as only maximum livestock on agricultural land and on main fodder area was determined. As the survey shows, the difference between sustainable farms and the whole of individual farms amounted to 23 p.p. (respectively 86 and 63% of farms dealt with animal production).

Structure of farms with breeding and rearing of particular group of animals was quite similar as regards sustainable farms and the whole of individual farms. In spite of including the livestock on fodder area criterion to the requirements of the sustainable farming, it did not "discriminated" farms with breeding of pigs. Basing on this we can state that not only farms holding animals classified as ruminants may run an environmentally friendly production.

Particular voivodships were differentiated in terms of share of farms which fulfill the sustainability criteria. No correlation was observed between fulfillment of particular criteria at regional level. The results are justified by the existing regional differentiation of agricultural production. The Podkarpackie and Kujawsko-Pomorskie voivodships singled out as having the highest share and the Podlaskie and Śląskie voivodships as having the smallest share of sustainable farms.

Farms being the main source of income for families constitute a basis of the Polish agriculture. The number of such farms was estimated at 664.000 (27% of the whole of individual farms). The sustainability of these farms is significant, or even prevailing, in terms of assessing the sustainability of individual farming. However, only 17.200 farms fulfill the all-5 environmental and production sustainability criteria, i.e. merely 2,6% of this population. This group remains interesting however as very prospective: to larger extent it fulfills the production, economic, social and environmental criteria. It is confirmed by average values of basic farm characteristics: area of agricultural land – 23,8 ha,

economic strength – 13 ESU, labor input – 1,97 JPZ and livestock – 7,5 SD. The predominance of this group over average values for corresponding characteristics of the whole of individual farms is significant and of quality nature.

The performed analysis indirectly confirms the thesis that production successes of predominant mass of farms are to the detriment of environment. This is how it is, when the pursuit for production maximizing and economic effectiveness does not take into account the environmental effects. It is important however to be able to reconcile different functions of agriculture and farms. These functions, including positive and negative environmental effects, integrally accompany any agricultural activity – and are coupled with it. Predominance of one of them, *eo ipso* their sustainability level largely depends on agricultural practices in use. Possibilities in this regarded are created however by changes in the agricultural structures and macro economical activities.

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SUBSISTENCE AGRICULTURAL HOLDINGS AND THE SUSTAINABLE DEVELOPMENT OF AGRICULTURE

1. Introduction

The subject of the study is the population of holdings using over a half of its generated final agricultural production for the needs of a family (household). These holdings, following the Central Statistical Office (GUS), will be called subsistence holdings. In the Polish agriculture it is numerically a significant group of agricultural holdings that only for that reason are meaningful for the concept of socially sustainable agriculture. The aim of the study is first of all to establish the value of features of holdings from this population in the regional system, based on the data of the GUS structural research conducted on a representative sample of approximately 200 thousand individual agricultural holdings[1]. This data enable to assess only some features of subsistence holdings, including the natural production potential, work inputs, crops and livestock of farm animals, the professional activity and sources of income of families. For the first time certain indexes of environmental and production sustainability of those holdings were also established. In some cases the results of subsistence holdings were compared with the data for the whole population and the so called commodity individual holdings conducting agricultural activity.

The empirical analysis was preceded with an outline of the genesis of subsistence holdings, and supplemented with comments on the influence of those holdings on the process of concentration in agriculture and the vitality of rural areas.

2. Genesis of the phenomenon of subsistence holdings

The general regularity of the economic development are changes in agriculture consisting among others in the fall of number of agricultural holdings and the concentration of land. The general economic development on

[1] The results of this research were published in: *Charakterystyka gospodarstw rolnych w 2005 r.,* GUS, Warszawa 2006. We based this study mainly on the listing prepared by the Statistical Office in Olsztyn for the needs of the research task „Socially sustainable agriculture". Hereinafter the data from those sources will be defined as GUS data.

one hand created a demand for the workforce migrating from agriculture, offering more attractive remuneration of work, on the other hand it supplied agriculture with newer and more efficient capital goods, including goods replacing the inputs of live work. This characterized the progress and technologic transformation in agriculture that had an enormous effect on the situation of family holdings, releasing significant work resources that could be spent outside agriculture. These holdings were under an economic obligation of making changes – with a choice of using one of the three basic possibilities: 1) increasing an agricultural holding, 2) liquidating an agricultural holding (migration from agriculture), 3) undertaking by a family other jobs in order to earn supplementary income to the income from an agricultural holding (two-professionality). In practice all those possibilities were used, however in the first case there are obvious barriers of land limitation; therefore, increasing one holding can be done at the expense of other holdings. As a result of the above choices – in developed countries – in the period of industrialization there was an enormous fall in the number of holdings with an increase of the area of an average agricultural holding. As a result a dual-shaped agrarian structure was shaped. On the one hand, there are big enterprise-like agricultural holdings, based mainly on paid workforce, private (also family) ownership and corporation ownership. On the other hand, there are family holdings, which base their activity on own workforce, earning their living from the agricultural activity (family commodity holdings) or from mixed sources (two-professional holdings). This dualism is increasingly noticeable also in the Polish agriculture. But contrary to the majority of developed countries, a significant number of economically weak agricultural holdings has survived, the families (households) connected with which have found other economic basis – other sources of income.

There are at least a couple of reasons of numerically big population of subsistence holdings in Poland and it is difficult to show the most important one without empirical analyses. Undoubtedly we deal here with the so called historical legacy – the agrarian overpopulation existing until the World War II, when the industrialization process only started. Next, war damage of towns and housing difficulties of people migrating from the country had their effect. By the way, this constituted one of the basic reasons of big numbers of the so called circular migration, which strengthens the phenomenon of subsistence holdings. Significant also is the settlement grid, which is relatively dense and enables commuting to work in towns. Probably an important reason have been relatively low remunerations of poorly qualified workers from agricultural families, who for this reason are forced to supplement the incomes (and later equally low

social benefits) with incomes from agricultural holdings. Finally, without aspiring to exhaust the list, an important role was played by the political factor in the period of the so called real socialism, consisting in the economic protection of agricultural holdings, including the protection under an economic compulsion, but also preventing concentration of land within an individual agriculture. Contemporarily a certain role is played by economic considerations in a form of land capitalization and psycho-social considerations, including living in relative isolation, in the bosom of nature.

3. The number of subsistence holdings

Subsistence holdings constitute over 2/5 of the total individual holdings conducting agricultural activity. The distribution of the number of those holdings is connected with the area of croplands. The relation consisting in the fall of the percentage of subsistence holdings together with transfer to area groups with a larger surface area is strong. For the holdings conducting agricultural activity a proper equation of regression in the form of logarithm function is as follows:

$$y = -28{,}149\mathrm{Ln}(x) + 67{,}743;\ (R^2 = 0{,}9733),$$

where: y – percentage of subsistence holdings, x – area of a holding in ha UR (croplands).

Therefore we should not be surprised by the fact that the area of croplands (UR) of half of the subsistence holdings does not exceed 1 ha, and in case of 9/10 of those holdings – 5 ha. However, it can be surprising that 4.3 thousand of subsistence holdings has at their disposal a cropland area of over 25 ha, including 0.7 thousand of holdings – an area of over 50 ha (162 holdings have at their disposal even over 100 ha UR). In those last area groups we probably deal with ill-fated incidents and the purchase of arable lands for hoarding and speculation purposes.

Table 1 presents the number and percentage of subsistence holdings in the regional (voivodeship) system. Attention is drawn by a large number of subsistence holdings in regions with fragmented agrarian structure, especially in Southern Poland. In three voivodeships: Małopolskie, Podkarpackie and Śląskie, as many as 46% of subsistence holdings are gathered. The basic conclusion that can be drawn from this data is the significant diversity of the percentage of subsistence holdings in the regional system. It is the highest in voivodeships with the most fragmented agriculture (Podkarpackie, Małopolskie and Śląskie). In those voivodeships subsistence holdings constitute 3/5 of the total individual holdings and 41% of croplands used by that sector of agriculture. An essential

influence on this has gathering mountainous areas in those voivodeships, because 2/3 of holdings in such areas are subsistence holdings (out of 79.6 thousand of individual holdings in mountainous areas, 52.4 thousand are subsistence holdings). The lowest percentage of subsistence holdings is not in voivodeships with the largest average holdings.

Table 1. The number and croplands of subsistence holdings (SAM) in the spatial system

Listing	Holdings			Croplands thousand ha		UR/holding ha	
	thousand		% SAM hold.				
	in total	SAM		in total	SAM	in total	SAM
Poland	2 472,8	1 015,0	41	13 728,7	2 228,7	5,55	2,20
dolnośląskie	115,3	44,0	38	734,3	84,5	6,37	1,92
kujawsko-pomorskie	101,1	28,9	29	929,3	57,0	9,19	1,98
lubelskie	279,4	93,5	33	1 422,6	219,6	5,09	2,35
lubuskie	45,1	21,0	47	350,2	70,2	7,77	3,35
łódzkie	182,0	52,6	29	1 042,2	146,2	5,73	2,78
małopolskie	312,7	186,8	60	662,3	281,7	2,12	1,51
mazowieckie	317,5	80,0	25	2 022,8	296,3	6,37	3,70
opolskie	59,9	25,1	42	372,2	36,7	6,21	1,46
podkarpackie	273,4	179,4	66	670,4	299,3	2,45	1,67
podlaskie	110,3	29,3	27	1 067,7	113,6	9,68	3,88
pomorskie	62,7	23,8	38	608,5	87,8	9,71	3,69
śląskie	185,5	103,1	56	418,0	132,5	2,25	1,29
świętokrzyskie	132,1	51,8	39	534,1	123,0	4,04	2,37
warmińsko-mazurskie	63,1	23,5	37	798,5	74,3	12,65	3,16
wielkopolskie	177,9	50,4	28	1 461,3	159,7	8,22	3,17
zachodniopomorskie	54,9	21,9	40	634,3	46,2	11,56	2,11

Source: *Worked out on the basis of GUS data.*

Therefore the subsistence character of a holding is determined also by other factors: the availability of alternative sources of income, other features of holdings and agricultural families. The average area of croplands in subsistence holdings is two and a half times lower than in total holdings. The largest differential is in zachodniopomorskie (5.5 times), lubelskie (4.6) and opolskie voivodeships (4.3), while the lowest is in voivodeships with fragmented agriculture: podkarpackie (1.5 times), małopolskie (1.7), śląskie, świętokrzyskie and mazowieckie (1.7 times).

4. Production and economic position of subsistence holdings

Subsistence holdings do not constitute a significant economic strength. Over 96% of those holdings fall into the lowest economic class, i.e. up to 2 ESU. Also the commodity production of those holdings does not have a greater meaning for the supply of food industry companies, however it has some meaning for the situation in the market, especially in the marketplace market. These holdings, however, have a significant percentage of croplands – 16.2% (i.e. 2.2 mln ha) and engage a significant percentage of work inputs (28.5%), to a large extent these are marginal inputs (and static ones).

Subsistence holdings keep relatively fewer farm animals (apart from horses) in relation to the owned croplands. They have 11.8% of cattle livestock, including 16.2% of cows livestock, a small percentage of pigs livestock (1.6%) and small percentages of sheep and goats livestock. However those holdings have as many as 44% of horses livestock in the individual agriculture. The arithmetics of the agrarian fragmentation causes that the remaining holdings – commodity holdings[2] – do not have a „shocking" majority in the scope of farm animals livestock density (without poultry) that amounts respectively to 0.53 SD/ha and 0.46 SD/ha (the difference is around 13%) despite a significantly larger percentage of croplands excluded from production (*vide* idle lands and fallows in table 3) in the first population. However, the percentage of stockless holdings is similar (37% of subsistence holdings and 38% of total holdings).

Subsistence holdings have 21.5% of tractors (over 300 thousand), however they are of lower power and older. Tractors are owned by 27.6% of subsistence holdings, i.e. over twice fewer than the remaining holdings (58.5%). On average in the population of individual holdings tractors are owned by 45.6% of holdings. Over 4/5 of subsistence holdings do not have agricultural machines, which condemns them to using the services in case of field cultivation. On the other hand, combine-harvesters are owned by as many as 14.1 thousand of those holdings.

[2] In those holdings the commodity production prevails, regardless of its size in absolute categories, which means the possibility of the existence of cases of subsistence holdings in which the value of commodity production will be higher than in some commodity holdings.

Table 2. The share of subsistence holdings in the values of selected features of the total individual holdings (per cent)

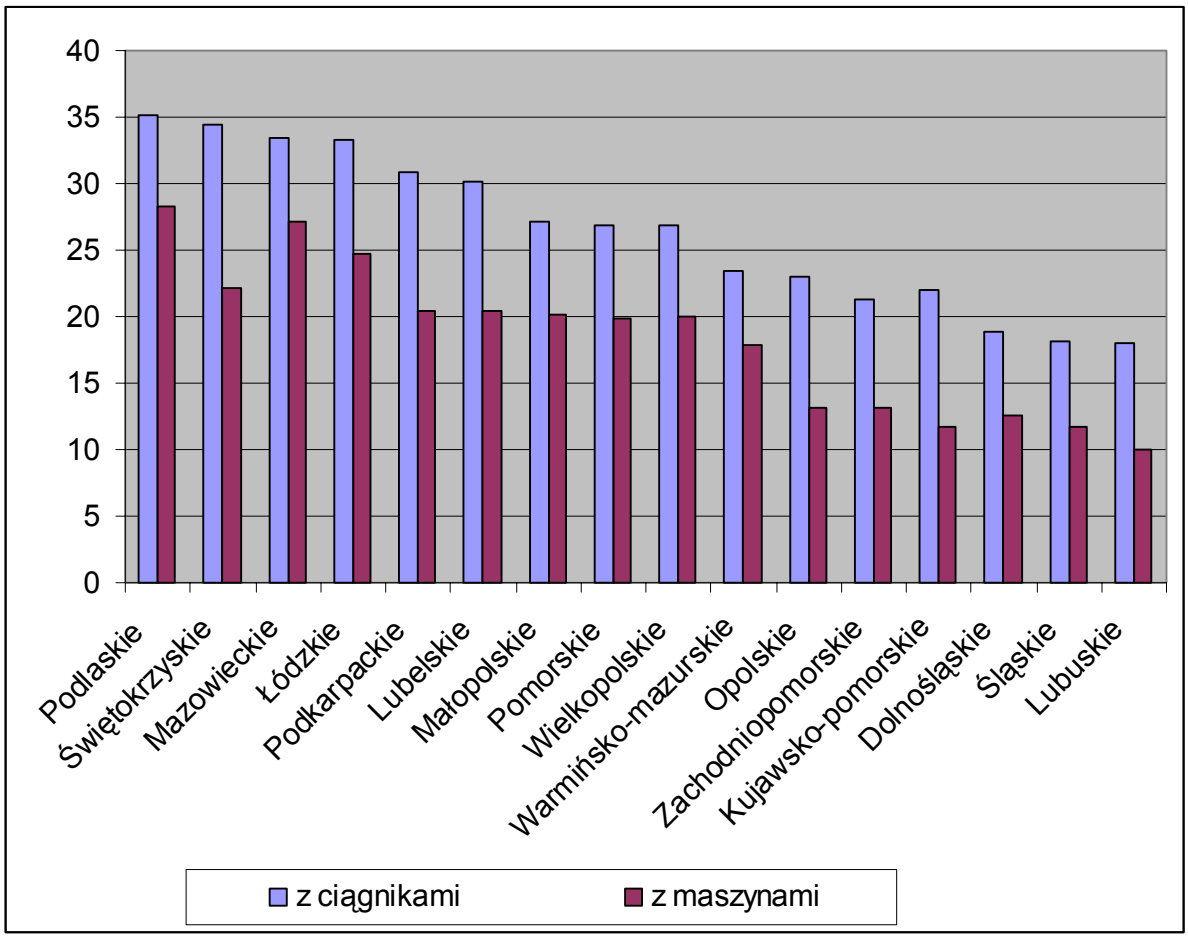
Listing	Croplands	Fallows and idle lands	JPZ[a]	Farm animals (SD)[b]	Cows	Agricultural source of income[c]
Poland	16,2	38,9	28,5	14,3	15,4	16,9
dolnośląskie	11,5	28,9	24,5	15,2	14,8	17,9
kujawsko-pomorskie	6,1	30,5	10,9	5,0	4,9	8,6
lubelskie	15,4	36,2	21,8	16,1	15,0	16,1
lubuskie	20,1	38,4	34,3	13,9	11,7	17,9
łódzkie	14,0	38,8	18,3	12,6	13,9	12,8
małopolskie	42,5	65,0	52,5	41,1	46,8	31,3
mazowieckie	14,6	27,9	18,2	14,7	14,7	14,2
opolskie	9,9	58,1	22,5	9,2	5,8	20,3
podkarpackie	44,6	65,0	58,9	42,7	48,1	38,5
podlaskie	10,6	43,7	15,3	6,3	5,6	9,6
pomorskie	14,4	37,5	24,3	13,8	12,9	15,8
śląskie	31,7	50,5	50,6	29,3	33,2	26,9
świętokrzyskie	23,0	45,6	30,1	22,2	22,8	20,0
warmińsko-mazurskie	9,3	28,5	19,1	7,0	7,0	15,8
wielkopolskie	10,9	25,3	15,1	9,2	9,6	13,0
zachodniopomorskie	7,3	20,8	20,7	10,2	9,0	15,4

[a] data concerns work inputs together with hired work (the share of work inputs of a family is by around 1 percentage point higher); [b] without poultry; [c] income from agricultural activity constitutes over 50% of a household income
Source: *GUS data*.

The equipment of subsistence holdings with tractors and agricultural machines is not determined by the area of croplands, but rather by the past and mentality of farmers, and probably also prestige considerations. An important meaning has undoubtedly the lack of developed mechanization services, because practically there are no agricultural associations, or other agricultural organizations, while private services – even if there are any – are sometimes too expensive.

Subsistence holdings use the croplands in a wrong way. Idle lands and fallows constitute 12.7% of arable lands, while in commodity holdings it is 3.4% (total individual holdings – 4.7%). Exclusion from production of around 190 thousand ha of arable lands constitutes an evident loss of the social economic benefit.

Drawing 1. The percentage of subsistence holdings with tractors and agricultural machines by voivodeships



with tractors with machines

Source: *Worked out on the basis of GUS data.*

5. The features of subsistence holdings

Subsistence holdings differ in terms of the values of the basic features. We will show some differences relating to the structure of croplands, human factor, crops, livestock and sources of income of families connected with agricultural holdings.

Subsistence holdings do not constitute some kind of curiosity in terms of the structure of arable lands. The basic distinctive features are a smaller area of croplands and a higher percentage of idle lands and fallows.

In relation to the animal production there are no differences in the frequency of holdings having farm animals between subsistence and commodity holdings (respectively 62 and 60% of holdings).

Table 3. The surface area and structure of lands in subsistence holdings by voivodeships

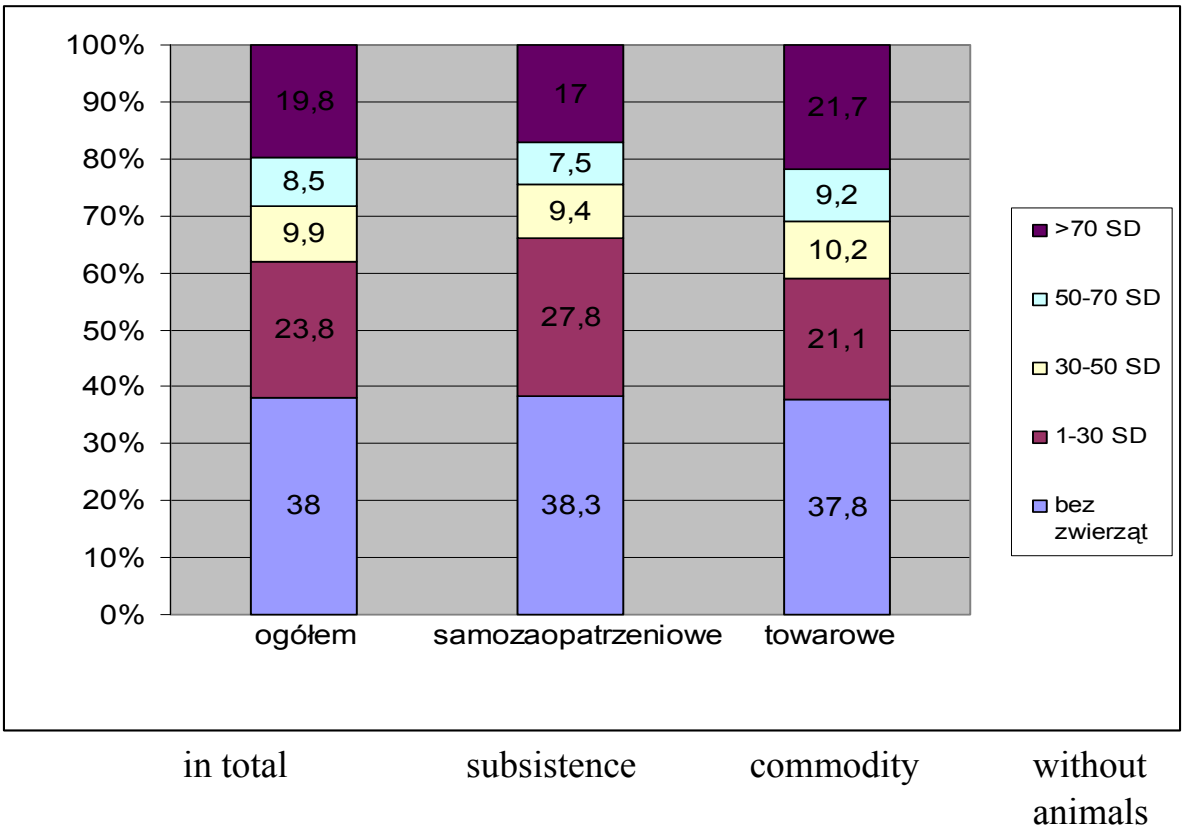
Listing	Total surface/ holding (ha)	Percentage of croplands	Percent age of forests	Arable lands in UR (per cent)	TUZ in UR (per cent)	Idle lands and fallows (per cent)
Poland	2,7	80,0	10,2	67,5	28,5	12,7
dolnośląskie	2,2	86,9	2,0	66,2	28,8	13,3
kujawsko-pomorskie	2,5	78,9	6,8	80,2	15,3	8,2
lubelskie	2,9	79,7	11,2	75,2	19,1	7,9
lubuskie	3,7	91,2	1,4	71,1	26,3	13,5
łódzkie	3,5	80,6	10,4	76,0	21,3	11,4
małopolskie	2,1	72,2	18,0	53,4	41,5	10,7
mazowieckie	4,5	81,6	10,5	67,0	29,8	11,2
opolskie	1,8	82,4	4,5	77,8	16,4	13,6
podkarpackie	2,1	78,2	9,5	61,8	33,4	19,0
podlaskie	5,1	76,4	14,2	61,9	36,6	17,6
pomorskie	4,6	79,6	11,1	74,0	23,3	16,9
śląskie	1,6	78,4	10,2	66,2	28,3	19,9
świętokrzyskie	2,9	81,2	9,4	70,4	26,3	11,2
warmińsko-mazurskie	3,8	83,7	5,1	54,3	43,5	16,6
wielkopolskie	3,6	88,2	5,2	81,9	15,7	3,5
zachodniopomorskie	2,4	86,9	1,4	73,3	22,8	25,9

Source: *GUS data*.

The process of agricultural deactivation of subsistence holdings however is proceeding, similar to reducing the significance of natural consumption, which, as a matter of fact, is in accordance with the general tendencies. This is indicated by the differences between subsistence holdings and commodity holdings in the scope of keeping individual kinds of animals. Therefore, the percentage of holdings with cattle is respectively 24 and 37%, cows – 22 and 35%, pigs – 19 and 35% and horses – 5.9 and 6.7%. This proves a smaller number of farm animals species kept by an average subsistence holding and giving up the breeding of milk cows and pigs. In the case of milk cows the differences are smaller than in the case of pigs. On average one subsistence holding has 0.5 pieces of cows, including a holding keeping 2.0 pieces of cows, while in commodity holdings this number is respectively 1.6 and 4.5 pieces. In the case of pigs, one subsistence holding has only 0.3 pieces, including a holding keeping 1.4 pieces of pigs, while in the case of commodity holdings these indexes are running at the level of respectively 10.8 and 31 pieces. The

differences are too much visible, despite the fact that the population of commodity holdings covers almost a million of holdings whose commodity status is only of a formal character – as a result of an ordinary arithmetic relation, and not the commodity production with a significant value. This causes that the structure of subsistence holdings in terms of the livestock density index does not differ significantly from the analogous structure of commodity holdings (dwg 2).

Drawing 2. The structure of holdings by the livestock density (SD/100 ha UR)



Source: *Worked out on the basis of GUS data.*

There are significant differences in the scope of livestock and livestock density of farm animals in subsistence holdings between voivodeships. This is proved by the data in table 4, where the data concerning sheep and goats were omitted, because of their small number. On average one holding has only 0.02 pieces of those animals (the biggest number is in the Małopolskie voivodeship – 0.03 pieces). The institution of a breadwinner cow is quickly being replaced by the advancing concentration – to a significant extent it only remains in Mazovia (strictly speaking in mazowieckie voivodeship). There are pigs in trace amounts, especially in Southern Poland, where still not so long ago it was usual to breed 1-2 pieces for own needs (the tradition of pig-sticking for Christmas and Easter).

So we deal with the process of retracting from production of subsistence holdings, or limiting it – also for the natural consumption. It is too early to judge whether this process will lead to the total disappearance of such production. Excessive unification, over-chemization of food and the interest in natural food can slow down this process.

Table 4. Selected data on animals in subsistence holdings by voivodeships (per one holding)

Listing	Livestock (SD)[a]	SD/100 ha UR	Cows (pieces)	Pigs (pieces)	Horses (pieces)
Poland	1,01	46,1	0,44	0,26	0,09
dolnośląskie	0,57	29,5	0,19	0,18	0,05
kujawsko-pomorskie	1,02	51,6	0,30	0,42	0,04
lubelskie	1,03	44,0	0,39	0,32	0,12
lubuskie	0,71	21,1	0,17	0,17	0,11
łódzkie	1,45	52,1	0,66	0,46	0,06
małopolskie	0,79	52,6	0,42	0,10	0,08
mazowieckie	2,02	54,5	1,04	0,49	0,18
opolskie	0,64	43,6	0,13	0,28	0,03
podkarpackie	0,63	37,9	0,33	0,09	0,08
podlaskie	1,58	40,8	0,80	0,30	0,11
pomorskie	1,55	42,1	0,45	0,56	0,13
śląskie	0,51	39,6	0,20	0,10	0,03
świętokrzyskie	1,15	48,4	0,48	0,23	0,15
warmińsko-mazurskie	1,43	45,2	0,57	0,23	0,18
wielkopolskie	2,07	65,2	0,58	0,95	0,06
zachodniopomorskie	0,66	31,1	0,20	0,20	0,06

[a] without poultry
Source: *GUS data*.

Subsistence holdings engage the work of 1952 thousand people. In a great majority it is part-time work, because, as it was established, the number of full-time workers is over three times smaller (640 thousand JPZ). In some cases probably an agricultural holding does not create the needs for a greater work inputs (small scale of production, without being oriented to the growth of agricultural production), in other cases there are physical limitations of spending the work of people engaged in an agricultural holding, and also in other cases an agricultural holding loses competition for work with other economic activities. However, in this respect commodity holdings cannot impress, because also there for each entity – full-time worker – there is a work input of two natural persons. It is also influenced by an average higher age of people working in an

agricultural holding, including especially a higher percentage of people of 65 and more years of age.

Work inputs do not exceed 1 JPZ in 4/5 of subsistence holdings, i.e. an amount similar to individual commodity holdings[3].

In relation to education, the natural course of time causes that the phenomenon of users without at least basic education is becoming outdated, its amounts are close to the state determined by ill-fated reasons. However, the phenomenon of lack of vocational (agricultural) education of users remains a problem. This relates still to almost half of commodity holdings and almost 3/4 of subsistence holdings (table 5).

Table 5. The human factor in total holdings, subsistence holdings and commodity holdings

Listing	JPZ/holding	JPZ/100 ha UR	Natural persons/JPZ	Perc. of workers ≥65 years of age	Percentage of users with education:	
					comprehensive	agricultural
In total	0,87	15,6	2,3	14,9	95,2	38,8
Subsistence	0,63	28,3	3,1	19,8	94,5	28,1
Commodity	1,04	13,2	2,0	11,8	95,7	462

Source: *GUS data*.

The diversity of the distinctive features relating to the human factor in a voivodeship system was presented in table 6. Let us notice that in tables 5 and 6 the data on work inputs (JPZ) relate only to working family members, i.e. they do not cover the permanent or temporary hired work.

The human factor is important especially in the use of chances that are created by the European integration. Lower economic activity of subsistence holdings seems to be justified, taking into account the orientation of an agricultural holding. Only 1.5% of subsistence holdings have benefited from the Rural Development Programme funds, which however constituted 32% of holdings benefiting from such funds (i.e. 15 thousand out of 46.7 thousand), respectively 12.8% have used the consultancy services, which constituted 22.2%

[3] On the basis of the data of the 2002 national census the percentage of subsistence holdings was established according to groups of work inputs per a holding: below 0.5 JPZ – 61.0% of holdings, 0.5-1 JPZ – 18% of holdings, 1-2 JPZ – 16.1%, 2-3 JPZ – 4.1%, 3 and more JPZ – 0.7% of holdings. See J.S. Zegar, □ród³a utrzymania rodzin zwi¹zanych z rolnictwem. IERiGŻ-PIB, Warszawa 2006, page 83, table III.9. Let us mention that in the period 2002-2005 the work inputs of a family in an average agricultural holding lowered by around 13% as a result of first of all increasing the number of holdings conducting agricultural activity.

of holdings using such services (130.4 thousand out of 586.6 thousand). In the production groups there are less than 0.5% of subsistence holdings, (4.4 thousand), but the activity in this scope is insignificant also in commodity holdings (0.7%, i.e. 10.6 thousand). A relatively small number of individual holdings benefited from subsidizing investments and undertaking an activity by young farmers, it amounted to 39.6 thousand, i.e. 1.6% of holdings. In case of subsistence holdings these numbers take respectively the values of 6.8 thousand and 0.7%.

Table 6. The human factor in subsistence holdings, by voivodeships

Listing	JPZ per		Natural persons/ JPZ[a]	Perc. of workers ≥65 years of age	Percentage of users with education:	
	holding	100 ha UR			comprehensive	agricultural
Poland	0,63	28,75	3,05	19,8	94,5	28,1
dolnośląskie	0,42	21,61	3,96	23,8	90,7	34,0
kujawsko-pomorskie	0,39	19,84	4,17	16,7	90,1	30,8
lubelskie	0,64	27,32	3,01	19,3	91,2	32,8
lubuskie	0,49	14,59	3,52	19,6	90,2	27,1
łódzkie	0,67	24,18	2,80	16,3	92,9	32,3
małopolskie	0,71	47,35	2,97	18,8	98,0	24,9
mazowieckie	0,76	20,45	2,61	16,1	91,7	30,7
opolskie	0,39	26,42	4,47	25,3	96,0	24,4
podkarpackie	0,71	42,78	2,88	22,4	96,7	23,8
podlaskie	0,63	16,24	2,90	18,8	90,9	35,7
pomorskie	0,59	16,09	3,08	15,0	92,9	31,6
śląskie	0,49	38,12	3,62	24,6	95,1	21,8
świętokrzyskie	0,86	36,03	2,45	20,1	99,4	29,6
warmińsko-mazurskie	0,48	15,33	3,47	19,8	91,9	32,7
wielkopolskie	0,55	17,51	3,22	13,5	93,9	36,7
zachodniopomorskie	0,33	15,45	4,70	19,8	85,6	29,3

[a] number of working natural persons per 1JPZ
Source: *GUS data*.

6. The professional activity and sources of income of families in subsistence holdings

The number of population connected with subsistence holdings can be estimated as 3.7 mln[4], it is around 10% of the country population, so it is quite a big social group. This is by no means a group of social population, as it is often defined, which probably origins from the commodity agricultural holding. 660 thousand people work as paid workforce, whereas an absolute majority (97%) works also additionally in an agricultural holding. Around 100 thousand people are engaged in own extra-agricultural activity. In agricultural holdings 1952.2 thousand people work, including exclusively – around 1200 thousand people, out of which for a significant part this is not the basic source of income. This is because a subsistence holding creates an opportunity to spend the marginal work. This first of all relates to people of advanced age. People of 65 and more years of age constitute 1/5 of people working in subsistence holdings. For these holdings there are 52.3% of people of 65 and more years of age working at all in individual holdings. This also has a meaning for keeping the psychophysical condition (and health) of those persons.

Table 7. Households connected with a user of an agricultural holding receiving incomes from extra-agricultural sources (in percentage of total holdings[a])

Listing	In total	SAM	Commodity
In total with extra-agricultural incomes	80,6	92,2	72,4
Extra-agricultural activity	8,4	7,3	9,1
Hired work	41,5	44,9	39,1
Retirement pays and pensions	42,8	53,1	35,7
Other non-earned sources	4,4	5,4	3,7

[a] data can exceed 100, because a household can have incomes from more than one extra-agricultural sources

Source: *GUS data*.

One of the most important features of contemporary individual agriculture is a growing separation of a household from an agricultural holding. This is proved by an increasingly smaller percentage of households connected with agriculture supported exclusively by one source – agricultural activity in own

[4] Assuming the same number of people in a subsistence holding as it was established on the basis of the 2002 national census data (on average 3.62). Compare *Ludność i gospodarstwa domowe związane z rolnictwem. Cz. II. Gospodarstwa domowe*. GUS, Warszawa 2003, tab. 7.

holding[5]. Around 4/5 of individual holdings conducting agricultural activity receives incomes also from other sources apart from their own agricultural activity. In case of subsistence holdings this is over 9/10, while in case of other holdings – almost 3/4 (table 7). These are high indexes proving the fundamental change of the status of a household in terms of spending work and sources of income.

In subsistence holdings we observe a greater frequency of incomes from hired work (the result of a greater employment competition outside an agricultural holding in relation to work in an agricultural holding), and especially incomes from retirement pays and pensions (a reflection of less beneficial age structure of people in this group). This indicates a common phenomenon of retired persons and pensioners supporting auxiliary agricultural holdings mainly oriented at subsistence. This expresses a relatively common phenomenon of pensioners in agriculture (a higher percentage of disabled people) and a low level of pensions and retirement pays forcing to maintain an auxiliary agricultural holding. Probably this is also the result of many other factors, including legal provisions on the agricultural system.

The frequency of existence of incomes from extra-agricultural sources, especially of individual sources, has some peculiarities connected with the spatial (regional) distribution. Most often there are incomes from retirement and pension benefits (53% of subsistence holdings). In the first place here is the podkarpackie voivodeship, where as many as 63% of subsistence holdings receive income from such source, next the małopolskie (58%) and the lubelskie voivodeships (56%). In the last positions there are voivodeships: mazowieckie (40%), opolskie (43%), wielkopolskie and kujawsko-pomorskie (45% each). There are the results of two-professionalism, as well as transferring agricultural holdings in return for retirement benefits.

The phenomenon of two-professionalism consisting in joining work in an agricultural holding and work outside agriculture was and still is particularly common in Southern Poland. The phenomenon of receiving incomes from hired work is mostly encountered in the voivodeships małopolskie (52%), podkarpackie (47%) and łódzkie (47%), and least in the voivodeships warmińsko-mazurskie (35%), dolnośląskie (38%), lubelskie and zachodniopomorskie (39% each), as well as wielkopolskie (40%).

[5] Such holdings – according to data of the 2002 national census – constituted only 7.8% of households connected with a user of an individual agricultural holding (220 thousand). See more J. S. Zegar, *ród³a utrzymania…*, *op. cit*.

Table 8. Subsistence holdings achieving extra-agricultural incomes by voivodeships

Listing	With extra-agricultural incomes	Extra-agricultural activity		Hired work		Retirement pays and pensions		Other non-earned sources	
		A	B	A	B	A	B	A	B
Poland	92,2	7,3	63,4	44,9	76,6	53,1	73,8	5,4	36,5
dolnośląskie	90,7	8,3	73,3	38,2	79,2	51,8	82,6	4,3	44,4
kujawsko-pomorskie	89,9	7,3	69,7	44,7	82,1	44,9	76,9	7,3	52,2
lubelskie	90,8	5,2	67,6	38,7	73,9	56,1	79,6	5,7	48,7
lubuskie	95,1	5,2	71,8	40,2	87,5	54,5	82,8	7,1	56,1
łódzkie	91,5	7,9	53,4	46,8	79,4	47,0	73,6	4,9	40,8
małopolskie	95,7	9,4	58,7	51,6	70,6	58,1	64,3	4,7	22,0
mazowieckie	85,8	8,3	70,2	44,2	77,6	39,9	75,1	5,6	31,8
opolskie	87,9	9,3	87,5	44,5	90,2	42,8	79,2	3,2	50,2
podkarpackie	96,4	4,4	62,4	47,4	72,5	63,0	70,6	6,4	26,6
podlaskie	90,4	6,3	63,0	45,1	81,3	46,6	75,8	5,8	35,8
pomorskie	89,4	11,5	68,1	46,4	78,4	46,0	66,4	7,7	38,5
śląskie	95,0	7,0	54,3	46,1	84,8	52,7	84,6	3,7	43,4
świętokrzyskie	87,7	7,1	56,0	40,2	74,5	51,1	70,6	4,1	42,0
warmińsko-mazurskie	86,1	5,6	52,8	35,4	82,6	48,4	82,7	9,0	49,0
wielkopolskie	86,4	10,7	72,5	39,9	78,9	45,2	73,5	5,4	43,5
zachodniopomorskie	90,6	8,4	64,6	38,7	82,6	51,6	84,2	5,4	46,6

A – percentage of holdings receiving income from a given source; B – holdings with a prevailing source of income in % of holdings receiving income from a given source
Source: *GUS data*.

Incomes from own extra-agricultural activity most often are present in voivodeships pomorskie (12%) and wielkopolskie (11%), and the least often in podkarpackie (4%), lubelskie and lubuskie (5% each) voivodeships. It is difficult to find one reason, however many signs indicate essential meaning in this respect of the so called human and social capital.

Attention is drawn by the differences in the scope of receiving incomes from a given source and a percentage of households for which they constitute a prevailing source of income (column B in table 8). In case of hired work, incomes from it constitute a prevailing source of income for 77% of families connected with subsistence holdings. In case of retirement and pension benefits, an analogous percentage is a little lower (74%), in case of own extra-agricultural activity 63% and in case of other non-earned sources of income – 36%. This indirectly indicates the relative amount of income from those sources. Incomes from hired work are obviously the biggest, however, generally speaking they are

low (the effect of low remunerations of poorly qualified workforce), incomes from social benefits are lower; and incomes from the extra-agricultural activity are also low on account of the character of this activity (in majority it is small trade). The lowest level of income from other non-earrrned sources of income is obvious and justified. We do not comment on the regional differences in this scope, because this would require a longer disquisition and quoting other data.

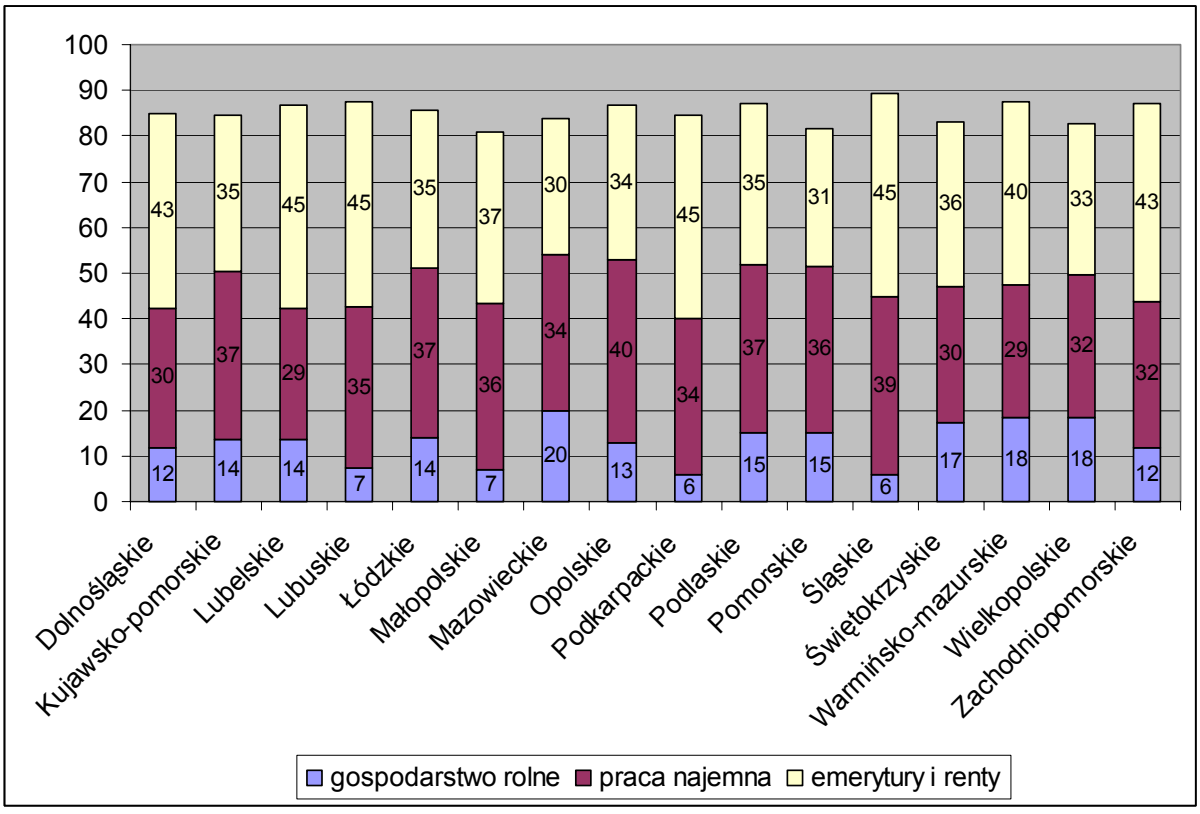
Achieving incomes from non-agricultural sources and the economic weakness in majority of subsistence microholdings determines the structure of families connected with those holdings, according to a prevailing source of income (table 9).

Table 9. The basic sources of income of families connected with individual holdings (per cent)

Listing	Agricultural holding	Hired work	Retirement pays and pensions
In total	26,9	29,7	27,1
Subsistence	11,0	34,4	39,2
Commodity	37,7	26,4	18,6

Source: *GUS data*.

Drawing 3. Basic sources of income of subsistence holdings by voivodeships (%)



agricultural holding hired work retirement pays and pensions

Source: Worked out on the basis of GUS data.

Families from subsistence holdings have defined – not social – sources of income. In the first place these are retirement and pension benefits, next incomes from hired work. An agricultural activity provides a dominant source of income for every tenth holding. However, this is not little and probably in majority it is connected with ill-fated incidents (special case). A greater problem is a too small percentage of commodity holdings earning their living from agriculture, resulting from the fragmentation of those holdings.

In the regional cross-section the distribution of a relative meaning of the basic sources of income is analogous as in case of achieving incomes. There is also a correlation with the situation of the total holdings in this scope[6].

Let us also pay attention to the phenomenon of two-professionality in the traditional meaning. So, the incomes from hired work constitute a prevailing source of income for 34% of families connected with subsistence holdings. This group constitutes the core of the phenomenon of two-professionality. To this group we need to add families where the prevailing source of income constitute joint incomes from an agricultural holding and hired work. The number of such families amounts to 87 thousand, out of which 37 thousand falls for subsistence holdings. Therefore hired work has an essential meaning for supporting 1/3 of families using actively an individual agricultural holding (i.e. with the agricultural activity), including 38% of subsistence holdings.

7. Sustainability of subsistence holdings

The ecological context, understood most generally as the conformity of activity conducted within an agricultural holding with the environmental requirements is increasingly important for the assessment of effectiveness of agricultural holdings. Measuring this conformity causes quite big difficulties in practice, first of all because of the methodological problems of measuring the effect of an agricultural activity on ecosystems, as well as difficulties of statistical nature. This is because this conformity is of a very local character. This means that a given agricultural activity, including some agricultural practices, can be in accordance with the requirements of ecosystems (not exceed their absorption abilities) depending on specific conditions. In other words, the statistical average indicates only the potential effect. The problem gets even more complicated if we are interested in the category of social efficiency, relating to the socially sustainable agriculture[7].

[6] In case of an agricultural source of income the Pearson's index of correlation takes the value of 0.87, in case of retirement pays and pensions – 0.77, and in case of hired work – only 0.59.

[7] In this matter see A. Woś, J. S. Zegar, *Rolnictwo społecznie zrównoważone*, IERiGŻ, Warszawa 2002.

The previous statistics does not allow directly for an assessment of the level of sustainability of agricultural holdings. Only selected indexes useful for a partial assessment are possible. Out of necessity we will limit ourselves to some environmental and production criteria[8].

Table 10. Holdings meeting the environmental and production criteria (in percentage of the total of a given group)

Listing	A	B	C	D	E
In total	35,8	41,2	27,2	44,4	97,5
Subsistence	42,8	27,7	22,7	42,4	97,0
Commodity	30,9	50,6	30,3	45,8	97,8

A – criterion of the share of corn (≤66%); B – criterion of the number of species in crop rotation (≥3); C – criterion of the share of surface covered with plants in winter (≥33%); D – criterion of the livestock density of ruminants SD/1 ha GPP (≤1,5); E – criterion of the livestock of farm animals SD/1 ha UR (≤2).
Source: *GUS data*.

The scale of agricultural production in subsistence holdings would suggest the conformity of those holdings with the environment. The formal criteria indicate that this is not happening. The criterion of the number of species in crop rotation and the criterion of the share of surface covered with plants in winter is met by a smaller percentage of subsistence holdings than it is happening in case of commodity holdings, while in case of the criterion of the share of corns the situation is opposite. Both cases can be easily justified with the sizes of production of subsistence holdings.

Table 11. The number of the environmental and production criteria of sustainability met by agricultural holdings (in percentage of the total of a given group)

Listing	1	2	3	4	5	6	7
In total	15,2	38,9	32,5	11,0	1,30	.	0,32
Subsistence	20,2	37,9	29,4	9,9	1,12	.	0,09
Commodity	11,7	40,4	34,7	11,8	1,43	.	0,47

Source: *GUS data*.

The data from table 11 suggest what seems a justified doubt regarding the use in relation to subsistence holdings of analogous environmental and production criteria as in case of commodity holdings. Taking into account

[8] See more in W. Wilk, Koncepcja wykorzystania danych rachunkowych FADN do ustalenia stopnia zrównoważenia gospodarstw rolnych, [in:] Koncepcja badañ nad rolnictwem społecznie zrównoważonym. Collective work under the direction of J. St. Zegar. IERiGŻ-PIB, Warszawa 2005, page 145.

simultaneously all five environmental and production criteria of sustainability of holdings, it turns out that they are met by a small fraction of individual holdings – only a little more than 1% (table 11). Supplementing the production and environmental criteria with the employment criterion (at least 1 JPZ in a holding) and the income criterion (the prevailing income from own agricultural activity), the number of holdings meeting simultaneously the seven criteria was established. A clear majority have commodity holdings, however these are completely marginal amounts.

A similar situation is in relation to ecological holdings that are also relatively rarely encountered among subsistence holdings than among commodity holdings. Organic subsistence holdings constitute 23.4% of the total organic holdings, including those earning their living from agriculture – 15.1%, while – let us remind – the share of subsistence holdings amounts to 41%.

8. Subsistence holdings and modernization of agriculture

A big number of subsistence holdings strongly determines the efficiency indexes of the Polish agriculture. An ordinary arithmetics determines it. The economic considerations, including in particular fighting off the competition on the agricultural and food market and improvement of agricultural incomes constitute important premises for the land concentration. This is in compliance with the dominant trend of the economic and agricultural thought, according to which the basic and at the same time unambiguously negative feature of the Polish agriculture is the fragmentation of the agrarian structure, which next translates into the economic weakness of the dominant mass of agricultural holdings. The view on the need for concentration in agriculture and inevitable displacing family holdings with great capitalistic agricultural holdings has its history[9]. Such holdings were supposed to constitute the only perspective form of agriculture. Admittedly, the possibility was permitted of the advantage of the peasant economy in relation to work-consuming and less capital-absorbing products, but in the remaining ones the advantage was absolutely on the side of capitalistic holdings (M. Weber). Marx's thesis on the advantage of large agricultural enterprises that they tried to fulfil in the period of real socialism, still has its followers – even too many – despite that great latifundia have become outdated. Large-surface capitalistic enterprises function better, however there is no clear decision in their favour. At present the thesis from the 1930's of

[9] The justification of such view is found among others in the study: K. Kautsky, Kwestia rolna. O tendencjach wspó³czesnej gospodarki rolnej i polityce rolnej socjaldemokracji, KiW, Warszawa 1958.

W. Sombart and A. Czajanow is reviving on the ability of family holdings to oppose great agricultural holdings[10].

The present agrarian structure undoubtedly constitutes an essential factor of ineffectiveness of the Polish agriculture. But this does not need to be exaggerated, because as it seems, the quality of the human factor (knowledge, enterprise), the state of agricultural institutions and the whole agricultural and food sector has not smaller, or even bigger significance. This obviously does not belittle the need for the improvement of the agrarian structure, understood as increasing the average area of a holding by reducing the number of agricultural holdings, which is followed by reducing the number of people engaged in agricultural activity. The increasing of the natural potential of agricultural holdings is important not only in the model of conventional (industrial) agriculture, but also in the model of sustainable agriculture, including organic agriculture[11], as well as for undertaking within an agricultural holding (agricultural family) an extra-agricultural activity, including agrotourism, providing environmental public goods, or resources for the needs of energetics. However, contrary to the model of industrial agriculture, in these remaining cases there is no need to increase the area of a holding to the size of a latifundium.

The fragmented agrarian structure is difficult to combine with the economic sustainability of an agricultural holding, but first of all with the requirement of competition of the sector and the pressure of globalization. From this a conclusion is drawn on the need, or even the necessity, to speed up the structural changes, including especially the land concentration, concentration of production and specialization and further intensification of production. The *panaceum* to solve almost all problems of Polish agriculture, as well as agriculture *in uniwersum*, are sought in it, directed by the path of agriculture development followed by the developed countries[12]. It is difficult to deny the need to deepen the land and production concentration in Polish agriculture. However, there are limits of this concentration outlined by the final increments principle, on the basis of which it is easy to establish the optimum relation work-land for specific conditions. And therefore the sizes of concentration of the production potential and the scale of production can be established and justified

[10] This is widely argumented by G. Schmitt in his article Why is the agriculture of advanced Western economies still organized by family farms? Will this continue to be so in the future? European Review of Agricultural Economics, vol. 18, no. 3-4, 1991.

[11] This was shown in article: J.S. Zegar, *Gospodarstwa ekologiczne w rolnictwie indywidualnym,* Wiadomości Statystyczne nr 10, 2006, s. 35-44.

[12] F. Tomczak, Gospodarka rodzinna w rolnictwie. Uwarunkowania i mechanizmy rozwoju, IRWiR PAN, Warszawa 2005.

economically, opposite for example to the capital concentration (in the economic sense), where it is difficult to establish the economic upper limit.

Large mechanized farms are not necessarily more effective than small family farms, if correct political instruments are used. Often there is a situation that smaller holdings are more effective. Looking forward, however, it is difficult to clearly assess the changes in the mutual relation of progress and area structure. In the age of biotechnology and genetic engineering the area structure can recede into the background, however if the innovations in this scope are commercialized by great concerns, then they will be more available for big agricultural holdings. The core of the problem of the agrarian structure consists however in the fact that small holdings – despite even high effectiveness – do not generate a sufficient income for a farmer and his family oriented at earning living from an agricultural holding. This causes that fragmented agriculture is poor, despite the fact that it is effective. This determines the need for a change in the agrarian structure towards increasing the area of holdings.

Deciding positively the need for concentration, first of all the speed of concentration has to be decided, and secondly cannons have to be found. In relation to the first issue it seems obvious to adjust the changes of the agrarian structure to the conditions and changing criteria of the social optimum. The state policy faces here a dilemma of choosing the lesser evil: not speeding up the changes of the agrarian structure and agreeing to concealed unemployment in peasant holdings or increasing the pace of changes in the agrarian structure and a greater disclosed unemployment in the extra-agricultural sector. *Tertium non datur*. Taking this into account we should be oriented rather to moderate changes in the agrarian structure of individual agriculture, adjusted to the actual demand for workforce. Increasing this demand creates conditions to speed up the changes of the agrarian structure. In each situation it is important to shape commodity holdings, earning their living mainly from an agricultural holding, having a competition ability; it is also important to speed up the integrations, combinations and improving the runner of holdings. Particularly important is connecting the structural changes with introducing the spatial order and shaping a valuable landscape on rural areas.

The second issue concerns the supply of agricultural land. The main barrier in the concentration process is not on the side of subsistence holdings, merely for the simple reason that they can offer relatively small natural potential for developing holdings. This potential should be mainly sought among non-subsistence holdings, i.e. holdings that produce mainly for the market, but with a small scale of production. The supply of lands from the side of subsistence holdings, because the process of concentration is mainly about it, requires

incurring significant transactional costs. The flow of land from those holdings basically results in a necessity of the above mentioned integrations, combinations and equipment undertakings. Not in all cases it would be even technically possible. And this costs quite a lot. Therefore holdings oriended at subsistence and low scale of production, with non-agricultural sources of income, can be regarded not only as a temporarily necessary[13] but also as a relatively permanent element of the structure of the Polish agriculture, which will be subject to self-limitation. At present it can be even regarded as a desired element, if it will be maintained within reasonable limits and will not aspire to support from the side of the state, however it is difficult to refuse help for such holdings, if highly commodity intensive agricultural holdings are benefiting from such help. Therefore the common suggestion that the public funds should be transferred only to intensive holdings, especially large-surface holdings, can be regarded as doubtful, or at least one-sided. This is justified neither socially, nor in accordance with the competition principle, however these groups have a decisive meaning now and probably in the future for shaping the situation on the agricultural market. The generally quoted argument of competition in the regional or global market cannot be defended.

Taking into consideration the above, one should not ignore the diversity of agricultural holdings in terms of the production potential, directing the activity, sources of support for families connected with agricultural holdings, etc.

9. Vitality of the rural areas

Subsistence holdings have to be considered also in the context of their influence of the vitality of the rural areas. At present almost in all developed countries the need to stop the phenomenon of depopulation that accompanied industrialization is stressed, as well as the meaning of maintaining a sufficient number of population in villages. This is particularly stressed in Europe, where a European model of a village is promoted, in which an essential role is played by the European model of agriculture. Keeping the population in rural areas requires creating jobs in industry/crafts, and especially in services to replace the reduced jobs in agriculture. The experiences of OECD countries show that it is easier to achieve in more urbanized regions (villages) than in highly agricultural

[13] Such necessity is indicated by many economists. For example E. Majewski states: „It is not possible however, even in conditions of most optimistic pace of the economic development of the country, to enable all farmers from small, low-commodity holdings to find jobs outside agriculture, as well as it is unreal to improve significantly the standard of their life through the system of social benefits". (E. Majewski, [in:] *Polska wieś 2025. Wizja rozwoju,* Pod red. J. Wiklina. Fundusz Współpracy, Warszawa 2005, page 92).

regions. The former use the effects of the general development, the latter are actually pushed into the background. In the former in general the number of population does not decrease, or even grows, while in the latter it decreases[14]. It is important to create jobs especially directly in the country or in nearby towns. New chances in this scope are created by the Internet.

Subsistence holdings, thanks to their mass, are important for the vitality of villages. First of all maintaining a certain level of population in the country is important for the demographic development and normal functioning of the technical and social infrastructure and public institutions. Next, families from subsistence holdings in 9/10 have the basic source of income outside the agricultural activity, however, in many cases an agricultural holding protects them against the material degradation. This economic meaning cannot be omitted. But at the same time we should not expect from those holdings progresses in the mass commodity production. Exceptionally important is the fact that the villages get a significant stream of incomes outside of the countryside – by hired work outside the countryside and by pension benefits and other social benefits. Moreover, you also have to take into consideration the growing meaning of public goods in the country for the tourism and recreation. Subsistence holdings change the rural landscape, and in some cases they can directly create conditions in this scope (agrotourism holdings). Finally – and this is a significant supplementation of the above arguments – practically there is no possibility of relocating such significant population of people to towns and cities.

In face of the above a question appears regarding the policy in relation to subsistence holdings, taking into account the advancing phenomenon of retracting from the agricultural production of users of such holdings. Basically the future of families owning such holdings does not constitute a problem. A family looks for an optimum use of their resources. The weakening position of an agricultural holding in the competition with other uses of work resources has to be taken into consideration, as well as the growing sensitivity of the food products quality, and the new valuation of free time. The economic relations also have to be taken into account, including the level and dynamics of remunerations and social benefits. This determines the possibility of maintaining an agricultural holding, even of small size, for balancing the economic bases of a family existence. Supporting the education of people from agricultural families (and rural families in general) and supporting the development of enterprise in the countryside will bring first of all higher incomes from hired work and the

[14] J. Byrden, R. Bollman, *Rural employment in industrialized countries,* Agricultural Economics, vol. 22, no 2/2000, page 185-197.

extra-agricultural activity, and next higher social benefits. As an effect, the relative (and probably absolute) meaning of incomes from agricultural activity in subsistence holdings will be reduced, which will favour the flow of arable lands from those holdings to other uses. This will of course favour reducing the number of this population of holdings, however it will be powered by holdings from the population of the so called commodity holdings, whose agricultural meaning is being reduced[15].

It is difficult to expect pro-production policy towards subsistence holdings in its conventional meaning. Nevertheless, for many such holdings maintaining agricultural production is a necessity. Maintaining own tractors or agricultural machines – apart from some exceptions – is not justified economically. The same is true for other fixed assets, including the majority of farm buildings, which simply should be written off. It would be advisable, however, to support the team forms of services and production cooperation. The membership of a certain part of users to producer groups proves such possibility. Niche production in subsistence holdings is not possible. The main direction of policy towards those holdings should consist in creating incentives and conditions for a better use of resources of agricultural land – also by integrations – and including those holdings in wider programmes of village activization. Organizing rural areas, introducing order in the rural space and solutions in the system of the agricultural tax and social insurances can stimulate releasing of unused or poorly used arable lands. However, the spatial order and maintaining the natural environment in good condition are more important than even the agricultural production. The natural environment and landscape are the natural resources of a village and one of the basic attributes of a village itself.

10. Summary and conclusions

Holdings producing mainly for the needs of own consumption constitute numerically a significant population in the Polish agriculture. They are the product of the historical development and for many reasons they can be regarded as relatively permanent element of the Polish agriculture. On one hand there is the liquidation of such holdings, on the other hand there are new supply holdings

[15] Data of the 2002 National Agricultural Census and data of the structural analysis 2005 indicate the fall of the number of subsistence holdings by around 10%. Without additional analyses, however, it is difficult to establish the reasons. The basic ones are: liquidation of subsistence holdings or transferring them to commodity groups (direct payments and other transfers connected with the CAP) and results of polarization in the group of commodity holdings.

as a result of the polarization process of the population of the so called commodity family holdings.

Subsistence holdings are weaker than the remaining agricultural holdings in terms of the production potential and the economic and production effectiveness. They do not have a greater meaning for providing the demand for agricultural products formulated by the companies of the agricultural and food industry. However they have some meaning for the agricultural market itself, including in particular the marketplace market and the direct sale.

A large part of subsistence holdings have extra-agricultural sources of income that in general are not sufficient and must be supplemented by incomes from an agricultural holding. Increasing incomes from other sources – apart from agricultural activity – favours limiting and even liquidating the agricultural activity.

Subsistence holdings engage a significant percentage of arable lands whose use in order to increase the commodity holdings, as well as other uses, is difficult because of relatively high transactional costs, technical difficulties and weaknesses of the spatial policy. This constitutes an important reason for maintaining a significant number of population of subsistence holdings, which in the nearest years will be strongly powered by the polarization process in the group of the so called commodity holdings.

Subsistence holdings do not have to be treated as a plague of the Polish countryside. On the contrary, their meaning for the vitality of the rural areas has to be appreciated. It is the greater, the higher the remunerations of hired workforce or people engaged in their own agricultural activity are. It has an obvious meaning for the current stream of income to families connected with subsistence holdings *eo ipso* of income reaching the countryside. This in turn has a meaning for the future incomes on account of social benefits. Supporting education of the rural population and the enterprise in rural areas has a fundamental meaning in this respect.

Sustainable holdings, first of all on account of a small intensity of production, can be regarded as emitting the environmental pollution with which the environment deals on its own. The formal criteria of environmental and production sustainability do not seem adequate to this population of agricultural holdings. The cases of exceeding the volume of local ecosystems by pollutions coming from such holdings can have only an incidental character. The issue of the spatial order is more complex, but this constitutes a separate problem.

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SUSTAINABLE FARMS IN THE LIGHT OF FADN DATA

1. Introduction

The purpose of this study is to evaluate the farms keeping the agricultural accounts under the FADN in 2004 in the light of sustainability requirements. In particular, the aim of this study is to determine the size and characteristics of farms that meet the environmental and production sustainability criteria.

The comparative analysis of the whole FADN population and of farms matching particular sustainability criteria was performed. Their characteristics in terms of production potential and social, environmental and economic aspect were presented. The research took into account the distribution of farms by macro-regions and by areas of unfavorable farming conditions (obszary o niekorzystnych warunkach gospodarowania, ONW).

The study uses the source data analysis method. The results are presented in the form of tables and diagrams.

2. Sustainability criteria[1] for the FADN farms

The wide range of unit data as well as the quantity of farms keeping the agricultural accounts allowed to analyze the farm sustainability in environmental and production aspect.

Farms are considered as sustainable in terms of environment and production if they show the following characteristics:

1) share of cereals in the sowing structure is not more than 66% [2],
2) crop rotation includes at least 3 plants,

[1] Concept of determining the sustainability of farms was presented in W. Wilk, *Koncepcja wykorzystania danych rachunkowych FADN do ustalenia stopnia zrównoważenia gospodarstw rolnych (Concept of Using the FADN Accounting Data to Determine the Sustainability of Farms),* [in:] *Concept of Research on Socially Sustainable Agriculture,* praca zbior. pod red. Zegar J. St., Program Wieloletni, Raport nr 11, IERiGŻ-PIB, Warszawa 2005.

[2] This index includes: cereals for grain (i.e.: durum wheat, common wheat, rye, barley, oats, triticale, cereal mixed, maize, other cereals (including buckwheat, millet)).

3) in winter at least 33% of agricultural land is covered by plants[3],

4) livestock of animals (cattle, sheep, goats, horses) on the main fodder area (główna powierzchnia paszowa, GPP) does not exceed 1,5 large animal[4],

5) livestock does not exceed 2 large animals[5] per 1 ha of agricultural land.

The above mentioned criteria were selected on the basis of "Code of Good Agricultural Practice" („Kodeks Dobrej Praktyki Rolniczej"[6], KDPR), "Common Good Agricultural Practice" („Zwykła Dobra Praktyka Rolnicza"[7], ZDPR) and the valid regulations of the agricultural and environmental law[8].

The most comprehensive in the light of the sustainable farming is the KDPR. „The code informs what is permitted and prohibited, prevent from committing offences, shapes the proper attitude of farmers towards the law in force and teaches how to reduce negative impact on the environment"[9]. Currently the comprehensive evaluation of farms in terms of complying with KDPR principles is not possible due to the lack of statistics in this area.

All the information which is accessible and important in terms of sustainability was taken into account.

3. Distribution of farms

The population of farms matching particular sustainability criteria is very differentiated (table 1). More than 90% of farms keeping the agricultural accounts matched the criterion of the number of species in crop rotation and the livestock on the agricultural land. These criteria seem to be the easiest to match. Approximately 60% of farms matched the criterion of the agricultural land covered by plants in winter and the livestock on the main fodder area. Only

[3] This index includes winter plants (i.e.: common wheat, rye, barley, triticale, cereal mixed, winter vetch, pulses mixed with other plants, rape, colza) and catch crops from agricultural areas.

[4] The ratio of livestock (cattle, sheep, goats, horses) to the main fodder area (główna powierzchnia paszowa, GPP) informs about subsistence of farm in terms of feeding stuffs. The main fodder area includes green areas and agriculture areas with root plants for fodder in the main crop.

[5] The ration of the livestock to the agriculture areas informs about maximum load of fertilizers in terms of environment.

[6] I. Duer i in., *Kodeks Dobrej Praktyki Rolniczej (Code of Good Agricultural Practice),* FAPA, Warszawa 2002.

[7] MRiRW, *Zwykła Dobra Praktyka Rolnicza (Common Good Agricultural Practice),,* FAPA, Warszawa 2003.

[8] Regulation of the Council of Ministers of 18th January 2005 amending the regulation on detailed conditions and procedure of granting the financial aid to support agricultural and environmental activities as well as to improve the animal welfare, covered by the rural areas development plan; Journal of Laws, no. 22, p. 178 and 179.

[9] I. Duer i in., *Kodeks ... (Code ...), op. cit.*

every third farm matched the requirement of the cereal share. Only 7% of farms matched all the five sustainability criteria[10].

Table 1. Number[a] of farms by the Polish macro-regions

Macro-regions [b]	Total FADN	GZŚP	Environmental and production sustainability criteria				
			cereals	species	winter crops	SD/GPP	SD/UR
Number of farms	12 338	815	4 322	11 308	7 457	7 558	11 361
Pomorze i Mazury (MI)	1 639	156	467	1 516	1 119	1264	1 534
Wielkopolska i Śląsk(MII)	4 030	311	1 285	3 732	2 926	2 445	3 508
Mazowsze i Podlasie (MIII)	5 142	259	1 949	4 727	2 705	2 861	4 861
Małopolska i Podkarpacie (MIV)	1 524	89	621	1 333	707	985	1455

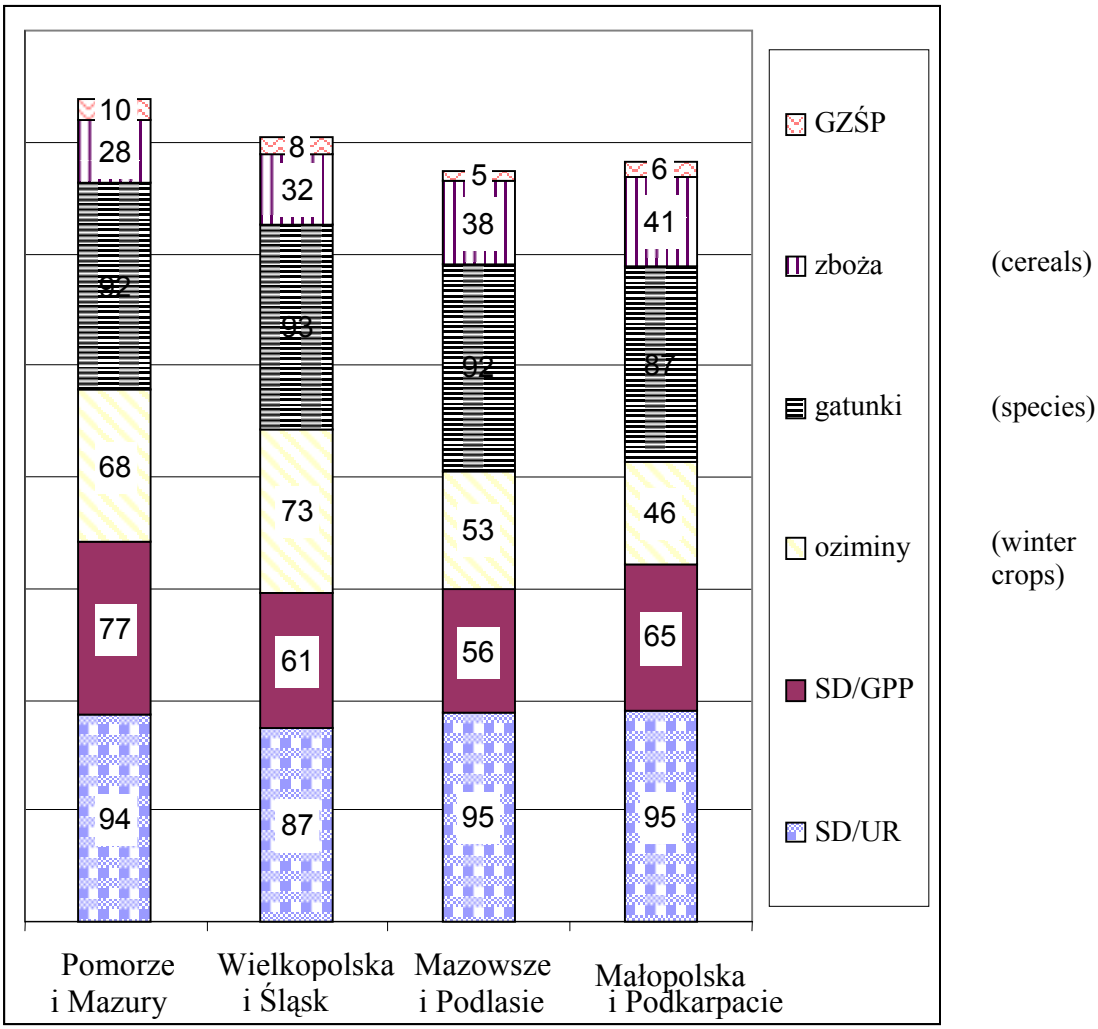
[a] the table does not include three farms for which there was no information on location in the FADN database.
[b] voivodships classified to particular macro-region: MI - warmińsko--mazurskie, pomorskie, lubuskie, zachodniopomorskie; MII - kujawsko-pomorskie, wielkopolskie, opolskie, dolnośląskie; MIII - mazowieckie, podlaskie, lubelskie, łódzkie; MIV -śląskie, małopolskie, świętokrzyskie, podkarpackie *Source: Own data.*

The distribution of farms matching the particular sustainability criteria in vertical section[11] for particular macro-regions is close to the distribution of all FADN population. Ii is mainly due to the total size of groups in particular regions. However, the analysis of distribution of farms in horizontal section[12], allows to observe certain differences in terms of matching the sustainability criteria between regions. The biggest share of sustainable farms was observed in Pomorze i Mazury (10%), the smallest in Mazowsze i Podlasie (5%) (fig. 1).

[10] In this study the following terms are used alternatively: a) farms matching simultaneously 5 criteria of environmental and production sustainability and sustainable farms, b) farms matching the criterion of cereal share in the sowing structure of the agricultural land and cereal criterion, c) farms matching the criterion of the number of species in crop rotation and species criterion, d) farms matching the criterion of area covered by plants in winter and winter crops criterion. All the tables and figures use the following abbreviations which inform about fulfillment of particular sustainability criteria (see p. 25-26): 1) cereals, 2) species, 3) winter crops, 4) SD/GPP, 5) SD/UR. The sustainable farms are marked with the abbreviation GZŚP.
[11] Assuming that the population of farms matching a particular criterion in a chosen macro-region will be compared to the total population of farms matching this criterion in Poland.
[12] Assuming that the population of farms matching a particular criterion in a chosen macro-region will be compared to the total population of farms in this macro-region.

The macro-regions were significantly differentiated in terms of share of farms matching the criterion of winter crops and livestock in GPP.

Fig. 1. Share of farms matching the sustainability criteria by the Polish macro-regions



Source: Own calculation.

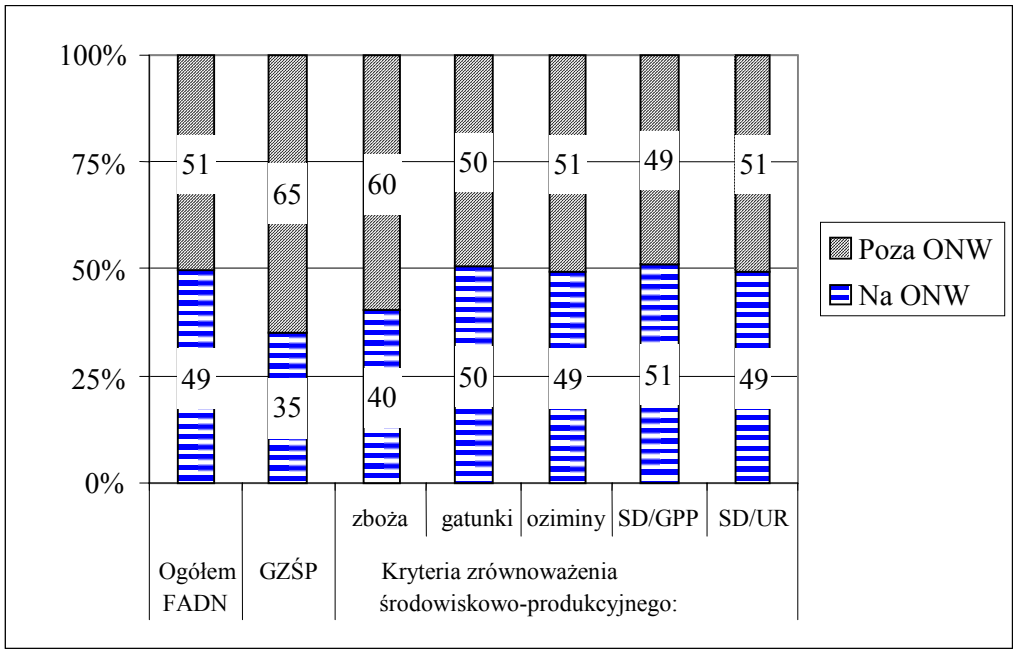
Since 2004 r. the Polish territory is divided into areas of unfavorable farming conditions (obszary o niekorzystnych warunkach gospodarowania, ONW). The basic reason for determining these areas was the possibility of obtaining financial grants in the framework of the Rural Area Development Plan in 2004-2006 for ensuring continuous agricultural usage of land, preserving the landscape variety of the rural areas and promoting the environment-friendly agriculture.

Approximately a half of agricultural land in Poland was qualified as ONW. The same proportion was also observed for the total FADN population and for farms matching the criterion of species number, livestock, and winter crops share (fig. 2). The differences were observed for farms matching the

criterion of cereals share – very large share of farms from outside of the ONW. This difference was even more visible in case of sustainable farms.

The distribution of farms within the non-mountainous and mountainous ONW was was comparable for groups of farms matching the sustainability criteria (within the non-mountainous areas the share in groups was 96-98%, within the mountainous areas 2-4%).

Fig. 2. Distribution of farms by ONW



ogółem FADN – total FADN
zboża – cereals
gatunki – species
oziminy – winter crops
Kryteria zrównoważenia środowiskowo-produkcyjnego – the environmental and production sustainability criteria

Source: own calculations.

4. Production potential of farms

The separated groups of farms were compared in terms of their production potential, taking into account the agricultural land and labor input (table 2). The biggest differences between groups were observed in terms of the area of arable land.

The agricultural land of the FADN farms and groups of farms matching the cereal criterion, species criterion and livestock criterion was within the range of 30-33 ha. The average agricultural land is slightly higher in farms matching the winter crops criterion and livestock on main fodder area criterion (35-37 ha). As regards the sustainable farms, the agricultural land was almost 58 ha.

The sustainable farms had the highest average share of arable land within the total of agricultural land (higher of 6 p.p. as compared to the average for the total FADN population) and lower share of permanent agricultural land and orchards.

The soils in farms matching the particular sustainability criteria were of average quality. However, taking into account the relation expressed in percentage, in case of sustainable farms the index of soil quality was approximately 20% higher as compared to the FADN population.

Regardless of the matched sustainability criterion, the chosen groups were characterized by similar labor input.

Table 2. Production Potential of Farms

Production potential	Total FADN	GZŚP	Environmental and production sustainability criteria				
			cereals	species	winter crops	SD/GPP	SD/UR
UR (agricultural land) area in ha	31,05	57,99	29,98	32,69	36,45	35,42	31,70
share of GO (arable land) in %	80,20	86,80	79,68	82,34	84,33	79,02	79,36
share of TUZ (permanent agricultural land) in %	15,47	11,59	14,35	16,36	14,81	14,43	15,98
Share of orchards in %	3,61	1,61	5,91	1,31	0,85	5,37	3,88
Index of soil quality	0,84	1,02	0,92	0,84	0,85	0,82	0,84
Own labor in JPZ [a]	1,72	1,68	1,7	1,73	1,71	1,66	1,72

[a] the number of fully-employed means the labor input incurred by the farmer's family, assuming that 1 JPZ works 2 200 hours a year *Source: Own calculation.*

5. Classification of farms by their economic strength and general agricultural type

The classification (typology) of farms in the European Union is based on the economic strength and agricultural type and takes into account the value of standard gross margin[13].

The economic strength expressed in ESU units allows to comprehensively determine the result of the farm, taking into account its real size, production incomes and related costs.

[13] Standard Gross Margin (abbreviated SGM) concerning a given crop or animal is: standard (average of 3 years in a given region) value of production from 1 hectare or one animal decreased of standard (...) direct costs necessary to generate this production (...). L. Goraj; *FADN i polski FADN (FADN and Polish FADN);* IERiGŻ-PIB, Warszawa 2005, p. 46.

The economic strength of the groups of farms fit in the range of 18-25 ESU (tab. 3). All groups of farms were classified as economically vital[14]. The sustainable farms were characterized by the highest economic strength (25% more of the average for the FADN population).

Table 3. Economic strength of analyzed farms

Economic strength	Total FADN	GZŚP	Environmental and production sustainability criteria				
			cereals	species	winter crops	SD/GPP	SD/UR
ESU	19,43	24,51	20,23	19,13	20,75	20,96	17,53
Difference (%)	100	126	104	98	107	108	90

Source: Own calculation.

The analyzed farm groups were divided into three classes of economic size, i.e. small, average and large (fig. 3)[15]. Almost every third farm keeping the agricultural accounts was classified as a small farm. More than 60% of farms were classified as average and 9% were classified as large. Also the other separated groups were characterized by the similar structure. Remarkable is the 4 p.p. higher share of large farms in the group of sustainable farms. This group had a significant impact on the average economic strength of the sustainable farms.

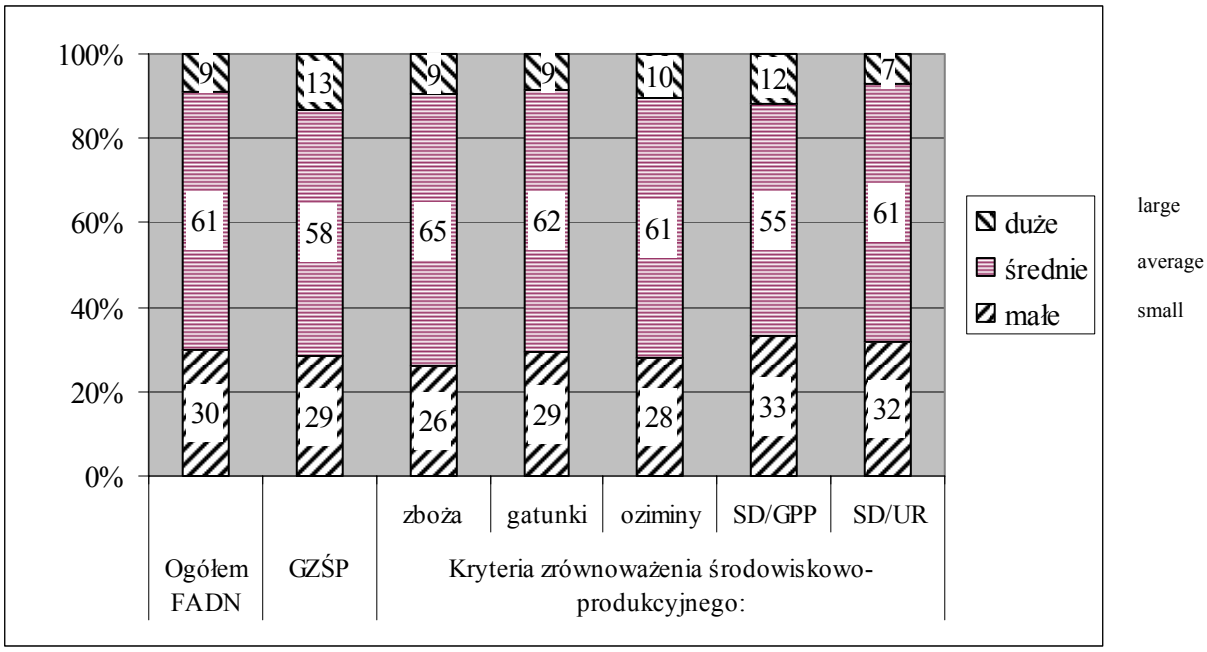
The second type of classification bases on general agricultural typology. The basis of this classification, similarly as the one before, is the standard gross margin reflecting the production system of the farm (tab. 4).

The structure of the analyzed farms was differentiated in terms of general agricultural type. Almost 1/3 of the total number of farms specialized in grazing livestock and specialist granivores. Every sixth farm specialized in field cropping. The share of horticultural farms and farms with permanent crops was insignificant (jointly 6%).

[14] The level of economic vitality of farms expressed in ESU units was determined for the needs of the activity "Support for semi-subsistence farms" of the Urban Area Development Plan for 2004-2006. The following division was adopted: non-vital farms – up to 2 ESU, semi-subsistence farms – 2-4 ESU, vital farms – 4 ESU and more.

[15] The classification of farms is based on the following division used in the European Union countries: small (up to 8 ESU), average (8-40 ESU), large (40 ESU and more). I. Augustyńska-Grzymek i inni, *Metodyka liczenia nadwyżki bezpośredniej i zasady typologii gospodarstw rolniczych (Methodology of calculation of gross margin and farm typology principles),* FAPA, Warszawa 2000.

Fig. 3. Economic strength of the analyzed farms[a]



ogółem FADN – total FADN
zboża – cereals
gatunki – species
oziminy – winter crops
Kryteria zrównoważenia środowiskowo-produkcyjnego – the environmental and production sustainability criteria
[a] excluding 312 farms for which there was no information on economic strength in the FADN database
Source: Own calculation.

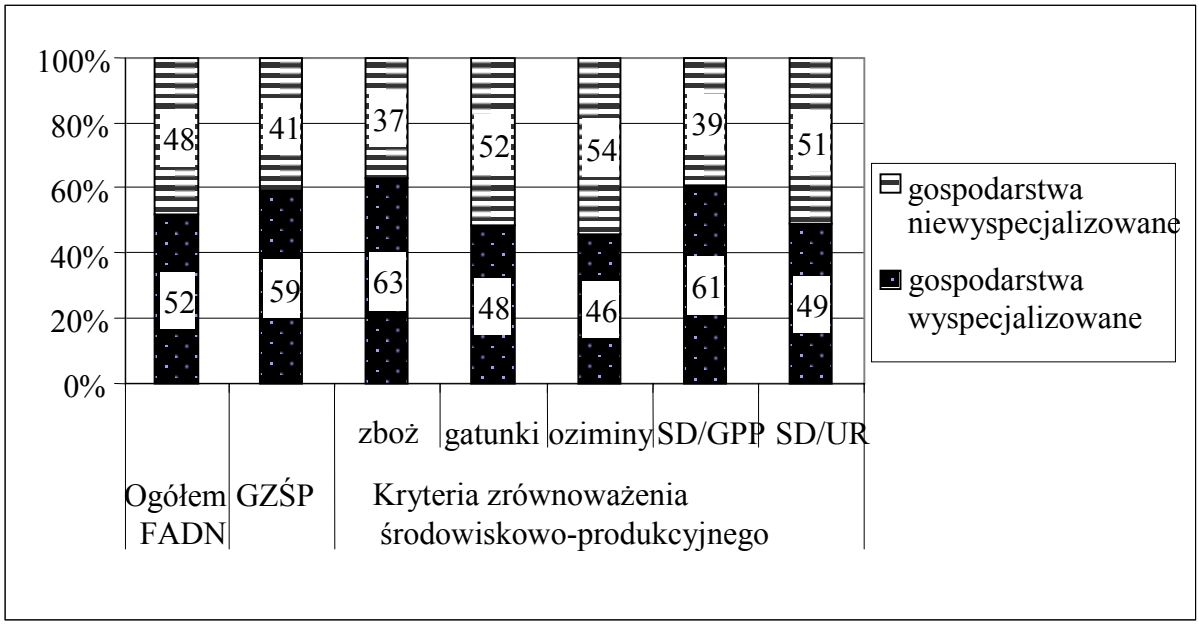
Table 4. Number[a] of farms in particular agricultural types

General types	Total FADN	GZŚP	Environmental and production sustainability criteria:				
			cereals	species	winter crops	SD/GPP	SD/UR
Field crops	1 816	350	942	1 705	1093	1 620	1 806
Horticultural crops	324	5	203	77	72	318	323
Permanent crops	418	8	257	82	45	411	417
Grazing livestock	2 107	86	1 133	2 090	962	743	2 045
Specialized granivores	1 549	19	101	1 390	1 163	1 343	837
Various crops	856	67	383	817	482	464	855
Various animals	2 515	62	484	2 512	1 771	902	2 354
Various crops and animals	2 441	196	702	2 398	1706	1 495	2 419

[a] excluding 312 farms for which there was no information on economic strength in the FADN database
Source: own calculation.

Farms specialized in field cropping accounted for 15-16% of the total of farms matching the winter crops criterion, species criterion, livestock criterion and of the total FADN population. Also the joint percentage of farms specialized in grazing livestock and specialist granivores was similar in the said groups (26 – 32%). Farms matching the cereals criterion were characterized by the highest percentage of farms specialized in grazing livestock.

Fig. 4. Production specialization of the analyzed farms[a]



ogółem FADN – total FADN
zboża – cereals
gatunki – species
oziminy – winter crops
Kryteria zrównoważenia środowiskowo-produkcyjnego – the environmental and production sustainability criteria
gospodarstwa niewyspecjalizowane – non-specialized farms
gospodarstwa wyspecjalizowane – specialized farms
[a] excluding 312 farms for which there was no information on economic strength in the FADN database
Source: Own calculation.

More than a half of farms keeping the agricultural accounts was specialized (fig. 4). The bigger share of specialized farms was observed in the group of sustainable farms (of 7 p.p.), which match the criterion of livestock on the main fodder area (of 9 p.p.) and cereals criterion (of 11 p.p.).[16]

[16] The criterion to recognize a farm as specialized of type general 1-5: the value of the ratio of the SGM of particular activity higher than 2/3 as compared to the total SGM of the farm. In non-specialized farms of type general 6-8 the SGM of particular activity was not higher than 2/3 of the total SGM of that farm.

6. Human factor

The human factor was characterized by input of own labor, contract labor and education level of person who manages the farm.

The labor input was similar in the analyzed groups (tab. 5), with the exception of the group which matches the cereals share criterion. In this group the labor input was higher of 17% as compared to the population keeping the agricultural accounts.

Table 5. Labor input in farms

Labor input	Total FADN	GZŚP	Environmental and production sustainability criteria:				
			cereal	species	winter crops	SD/GPP	SD/UR
Ow labor and contract labor in JPZ	2,12	2,33	2,48	2,01	1,96	2,24	2,11
Difference in %	100	110	117	95	93	106	100

Source: own calculation.

Each group was dominated by the share of persons with basic vocational education (from 38% in GZŚP to 46% for farms matching the species and winter crops criterion) and with secondary education (from 39% for the total FADN population, for farms matching the species criterion, winter crops criterion and livestock on agricultural land criterion, up to 44% for the GZŚP group) (tab. 6).

Table 6. Number of farms by education level of person managing the farm[a]

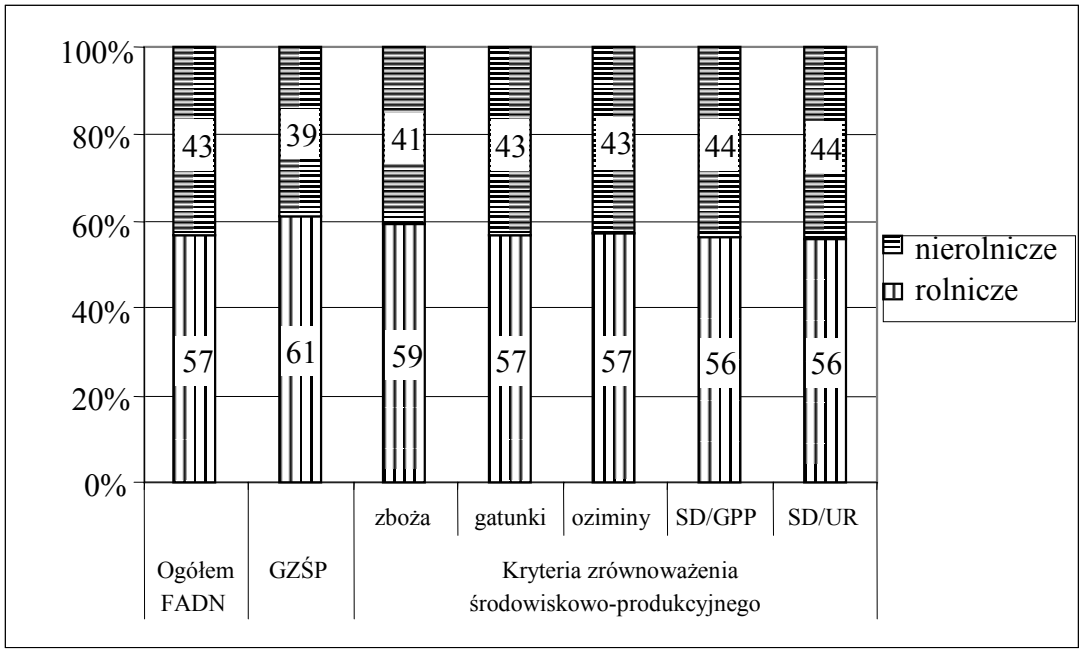
Education level	Total FADN	GZŚP	Environmental and production sustainability criteria:				
			cereals	species	winter crops	SD/GPP	SD/UR
Basic	1 043	45	336	1 016	598	558	990
Vocational	5 441	308	1 704	5 180	3 443	3 039	5 009
Secondary	4 872	357	1 833	4 363	2 873	3 177	4 447
Higher	979	105	449	749	543	781	912

[a] the presented data do not include 3 farms for which there was no information on education in the FADN database.
Source: Own calculation.

The share of persons with basic education (7-9%) and higher education (7-10%) in analyzed groups was similar, with the exception of sustainable farms (highest share of persons with higher education among farm managers (13%) and simultaneously lowest share of persons with basic education (6%)).

More than a half of farm managers was professionally prepared to perform the work (fig. 5). The sustainable farms had the highest share of persons with agricultural education.

Fig. 5. Education of farm managers[a]



ogółem FADN – total FADN
zboża – cereals
gatunki – species
oziminy – winter crops
Kryteria zrównoważenia środowiskowo-produkcyjnego – the environmental and production sustainability criteria
nierolnicze – non-agricultural
rolnicze – agricultural

[a] the presented data do not include 3 farms for which there was no information on education in the FADN database.

Source: Own calculation.

7. Environmental issues

The FADN population was also analyzed in terms of farming system. For this purpose 3 groups of farms were differentiated, i.e. organic farms, farms during transformation towards the organic production and conventional farms.

The percent share of organic farms (from 0,68 to 1,74%) and farms in transformation (from 0,34 to 0,74%) within the analyzed groups of farms was significant. Remarkable is the share of organic farms (1,35%) and farms in

transformation towards organic production (0,74%) within the group of sustainable farms (tab. 7).

Fertilizers and Plant Protection Products management is an important environmental and production issue (table 8).

The value of mineral fertilizers used (as well as detailed fertilizers' groups, i.e. nitric, phosphoric, potassium, multi-component) was close to the average for the analyzed population, with the exception of farms matching the cereals criterion (fertilization level higher of 21%) and sustainable farms fertilization level higher of 35%).

Table 7. Farms by the production system (%)[a]

Groups of farms	Total FADN	GZŚP	Environmental and production sustainability criteria:				
			cereal	species	winter crops	SD/GPP	SD/UR
Organic	1,04	1,35	1,74	1,06	0,68	1,18	1,10
In transformation towards organic production	0,44	0,74	0,51	0,42	0,34	0,50	0,47
Conventional	98,52	97,91	97,76	98,51	9898	98,32	98,43

[a] the presented data do not include 3 farms for which there was no information on FADN production system in the FADN database
Source: Own calculation.

Table 8. Value of means of production used

Mean of production	Total FADN	GZŚP	Environmental and production sustainability criteria:				
			cereal	species	winter crops	SD/GPP	SD/UR
Fertilizers N/ ha UR in PLN	173	253	205	172	184	176	173
Fertilizers P/ ha UR in PLN	17	27	22	17	17	17	17
Fertilizers K/ ha UR in PLN	24	33	32	24	22	25	24
Multi-component fertilizers/ ha UR in PLN	167	202	203	154	158	178	165
Total fertilizers/ ha UR in PLN	381	515	462	367	381	395	380
Plant Protection Products/ ha UR in	191	299	267	174	186	213	193

Source: Own calculation.

The expenses on plant protection products are distributed similarly (40% higher in case of farms matching the cereals criterion and 56% higher in case of sustainable farms).

The groups of farms matching the sustainability criterion were separated under in terms of one priority condition. The configuration of the fulfilled conditions was of less importance. Only the group of sustainable farms (815 farms) included farms which fulfilled 5 criteria simultaneously.

Table 9 presents the combination of matching couples of criteria by farms. More than 90% of farms matching the sustainability criteria, i.e. cereals, species, winter crops and stock on GPP, also matched the criterion of livestock on agricultural land. Also approximately 60% of farms in each of the specified groups were characterized by the expected share of winter crops. As manifested by the presented combinations, most difficult second criterion to fulfill was the share of cereals (from 23% in criteria combination: winter crops and cereals, to 35% in combination: stock per UR (agricultural land) and cereals).

Table 9. Number of farms matching at least two sustainability criteria

Sustainability criteria	Environmental and production sustainability criteria:				
	cereals	species	winter crops	SD/GPP	SD/UR
Total FADN	4 322	11 308	7 457	7 558	11 361
Share of cereals	4 322	3 742	1 696	2 544	4 137
Number of species	3 742	11 308	7 286	6 536	10 448
Share of winter crops	1 696	7 286	7 457	4 447	6 761
Stock SD/1 ha GPP (main fodder area)	2 544	6 536	4 447	7 558	6 914
Stock SD/1 ha UR (agricultural land)	4 137	10 448	6 761	6 914	11 361

Source: Own calculation.

8. Production and economic results

The total production is the first of the resultant categories. It is the total of the plant, animal and other production (tab. 10)[17]. The groups of farms varied in terms of the total production. The farms which matched the species criterion had

[17] The total production includes sales, internal use and transfer of plant and animal products as well as animals to the farmhouses, movements on stock of animal and plant products, change of the value of animals decreased of their purchase. Other production includes rental for land ready for sowing, receipts from occasional letting of fodder areas, receipts for animals held under contract, forestry products, contract work for others, hiring out of equipment, interest on liquid assets necessary for running the holding, receipts of tourism, receipts relating to previous accounting years, other products and receipts. See *Wyniki standardowe uzyskane przez indywidualne gospodarstwa rolne prowadzące rachunkowość w 2004 r. (Standard Results of Individual Farms Keeping the Accounts in 2004),* Praca zbior. prac. ZRR, IERiGŻ-PIB, Warszawa 2005, s. 19-29.

lower value of the total production (of 11%) and farms matching the livestock on GPP criterion had higher value of total production (of 18%) as compared to the average for the FADN population. The most noticeable result was observed for sustainable farms where the total production was higher of 36% as compared to the average.

Another category used for estimations and comparisons of farms is the commercial production which includes sales value of plant and animal products as well as animals.

The ratios between analyzed groups in terms of commercial production are analogous as in case of total production. The farms matching 5 sustainable criteria achieved results better of 40% as compared the total analyzed population.

The category used most often is the income from family farm. This is the remuneration for using own means of production for operational activities and for the risk taken by the farm manager in the accounting year (profit or loss)[18]. In this category the difference between analyzed groups of farms was visible much cleanlier (the income of sustainable farms higher of 60% as compared to the total population).

The reason for this ratio was, among others, lower level of the following costs: direct costs, total farming overheads, external factors costs, amortization costs or higher level of positive balance of subventions and taxes.

The evolution of income from the family farm in relation to the number of family members and own labor inputs was similar.

The sustainable farms were characterized by lower income per 1 ha UR (of 13%), similarly as other groups (species – of 10%, winter crops – of 13%, SD/GPP – of 1%, SD/UR – of 11%) in relation to the total population, with the exception of farms matching the cereals criterion – it could have been due to relatively lower agricultural area as compared to other farm groups.

The off-farm income of the farmer's family includes incomes from contract work (decreased of advance for the income tax), pensions, disability payments, other social benefits (e.g. indemnities on social assurance, allowances) and incomes from other sources. As collected data show, the higher values in this category were observed for farms matching at least one

[18] Alternatively, this is the total production decreased of indirect use (i.e. direct costs and total farming overheads), amortization, costs of external means (i.e. remuneration, rentals, interests), increased of balance of subventions and taxes on operational activity and investments. Payment for farmer's and his family's labor as well as for the capital contributed (land and other assets) are not included in the income account. See *Wyniki standardowe uzyskane przez indywidualne gospodarstwa (Standard Results of Individual Farms ...),* op. cit., p. 25-33.

criterion, i.e. balanced stock on main fodder area (13%) and on agricultural area (4%) or sustainable farms (of more than 30%) in relation to the result of FADN population.

Table 10. Production and economic results of groups of farms (PLN)

Results	Total FADN	GZŚP	Environmental and production sustainability criteria:				
			cereals	species	winter crops	SD/GPP	SD/UR
Total production	177 377	242 344	199 315	157 291	174 581	209 571	153 955
Commercial production	151 361	211 592	179 911	127 220	141 418	183 621	127 499
Income from family farm DR	50 855	82 404	63 108	48 357	51 755	57 305	46 060
DR/1 ha UR	1 638	1 421	2 105	1 479	1 420	1 618	1 453
DR/1 member of family	13 106	21 890	16 002	12 309	13 441	15 202	11 857
DR/1 JPZ[a]	29 587	49 113	35 623	27 911	30 253	34 445	26 841
Off-farm income of the farmer's family[b]	4 661	6 122	4 461	4 621	4 554	5 287	4 840

[a] DR/1 JPZ means the value of income from family farm per one fully-employed family member in the farm; [b] Farmers keeping the accounts under FADN are not obligated to provide information on off-farm incomes. Persons who wish to give access to this information fill in the "Questionnaire on off-farm incomes from farm belonging to the farmer's family". The off-farm incomes were disclosed by 79% of the analyzed FADN population. The mentioned data concern only these farms
Source. Own calculation.

9. Summary and conclusions

The study shows the results of research on population of farms keeping the agricultural accounts. The farms were analyzed in terms of environmental and production sustainability. The separated group of sustainable farms (matching all 5 environmental and production sustainability criteria) accounted for 7% of the total FADN population.

The frequency of farms which match at least one of the five sustainability criteria, confirms the various level of difficulty in fulfilling these criteria. The largest group consisted of farms matching the livestock on agricultural areas criterion, the smallest group included farms matching the cereals share criterion.

Low percentage of sustainable farms confirms that only a small group of farms is capable to fulfill all the sustainability criteria. Therefore methods of qualification to sustainable farm group need to be reconsidered. By wider range

of criteria, the assessment of farms should be based on matching a determined percentage of criteria for each of three aspects (i.e. social, economic and environmental and production aspect). This is confirmed by the analysis at the regional level. Macro-regions differed by percentage of farm matching all the criteria. The largest number of sustainable farms is in Pomorze and Mazury, the smallest in Mazowsze and Podlasie. These regions also differ in terms of fulfillment of particular criteria. We can guess that each of regions is characterized by different percentage of farms fulfilling specific criterion which results from the specificity and differentiation of the Polish agriculture.

The selected ONW areas should invite farmers to particularly "precise" farming. As the survey shows, there were only a small number of sustainable farms within the areas of unfavorable farming conditions. Farmers who run farms located in areas characterized by optimal natural and water conditions, flat area, good quality of soils should be more interested in sustainable farming.

The sustainable farms significantly differed in terms of area of agricultural land. Simultaneously, were characterized by similar labor input as compared to the whole FADN population. It is an evidence that labor is used more efficiently in relation to the farms' area. Also the economic results in this group were relatively high.

The group of sustainable farms includes a significant percentage of large farms (classification by the economic strength). It confirms that the surveyed method of farming is suitable also for this group. As often stated, the environmentally friendly agriculture is possible only in case of small and extensive farms. It shows however, that the essence is a certain production proportion and not the size of farm.

Both the education level and professional training preparing for becoming a farmer (i.e. the farm manager should have an agricultural education) may have an influence on sustainable farming.

Sustainable and organic farms are linked by the idea of sustainable development, however concepts and criteria for their selection are different.

The value of production means used in sustainable farms was higher as compared to the FADN population. However, knowing the expenditures is not enough to estimate the sustainability. The core is the balance of particular fertilizing factors in soil. Frequently the price of mineral fertilizers is related to their price.

The group of sustainable farms as well as their relatively good economic results needs to be further investigated. The analysis in terms of economic strength and physical size is needed. According to the results of survey, it is possible to maintain socially and environmentally friendly farm which still

ensures high level of income. The new criteria for selection of sustainable farms should be identified, not only in terms of environment and production but also in social and economic terms.

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DESCRIPTION OF ORGANIC HOLDINGS IN POLAND

1. Introduction

Two organizational forms of sustainable agriculture are legally authorized in Poland, namely the so called integrated production (holding) and organic holdings. They are under the supervision of respectively the Main Inspectorate of Plant Health and Seed Inspection and the Agricultural and Food Quality Inspection[1]. Both forms – with a similar scale – are at present a margin significantly smaller than in other countries of the European Union. However, we should take into account the development of those forms of agriculture, despite more strict environmental and production requirements, and this because of the granted support from public funds, the growing demand for organic products (i.e. created in harmony with the natural environment), as well as their advantages in the context of some features of the natural production potential of a holding.

The subject of our interest in this study is only the latter form, i.e. organic holdings[2], that were separated from the whole population of holdings analysed in June 2005 by the Central Statistical Office (GUS)[3]. In the analysis of

[1] The requirements of organic agriculture are defined in the act of 20 April 2004 on organic agriculture (Journal of Laws of 2004, No. 93, item 898) and a regulation of the minister of agriculture and rural development of 14 May 2002 on detailed conditions of producing organic agriculture products (Journal of Laws No. 77, item 699), while the requirements of integrated agriculture are defined in the act of 18 December 2003 on plant protection (Journal of Laws of 2004, No. 11, item 94) and a regulation of the minister of agriculture and rural development of 26 July 2004 on integrated production (Journal of Laws No. 178, item 1834).

[2] Organic holdings have been the subject of many studies, among which we can mention the following: M. Górny, *Ekofilozofia rolnictwa,* CEEW, Krosno 1992; G. Niewęgłowska, *Gospodarstwa ekologiczne w Polsce,* IERiGŻ-PIB, Warszawa 2005; H. Runowski, *Ograniczenia i szanse rolnictwa ekologicznego,* Wyd. SGGW, Warszawa 1996; U. Sołtysiak, *Atestacja i oznakowanie produktów i gospodarstw ekologicznych w Polsce na tle sytuacji w Europie. Ekologiczne i integrowane rolnictwo w Polsce. Raport,* Wyd. SGGW, Warszawa 1995.

[3] The analysis was conducted on a representative sample of over 200 thousand agricultural holdings. The results of these analyses were published in: *Charakterystyka gospodarstw rolnych w 2005 r.,* GUS, Warszawa 2006.

organic holdings we assume the principle of comparing the values of selected features of those holdings and the total population of agricultural holdings and in some cases the features of some groups of holdings from those populations. A small percentage of organic holdings causes that the average data for the total holdings practically do not differ from the remaining holdings (i.e. non-organic holdings), if such group was separated. Therefore the results of the comparative analysis can be related to organic holdings and the remaining holdings. The scope of the analysis is of course conditioned by the statistical data gathered and made available in the mentioned publication. On this account the analysis covers holdings of all forms of ownership conducting agricultural activity (as of June 2005). The structural research of GUS did not include data on the value of agricultural production and achieved incomes. This makes it impossible to perform a direct comparative analysis of the economic effectiveness. These aspects can be presented only indirectly – via the surface area, crops structure, livestock of farm animals and sources of income of households.

The conducted standard, simple analysis is aimed at initial recognition of characteristics of organic farms and establishing the method of further research.

2. The number and users of organic holdings

The number of registered organic holdings is so far scanty, as it amounts only to 4050, as compared with 2476.5 thousand of holdings conducting agricultural production (0.16%). These holdings have only 0.68% of the total surface, 0.66% of croplands and 0.47% of arable lands used by the total number of holdings conducting agricultural activity. Clearly bigger is an analogous percentage in case of permanent meadows and grazing lands, however also in this case it is scanty (1.25%). This directly indicates a greater area of organic holdings, which is confirmed by the distribution of the number of those holdings by area groups quoted in table 1 and in drawing 1.

The reasons of differences in the numerical distribution are obvious. First of all a holding must have a certain production potential, in order to achieve a satisfying income with the organic agriculture technologies that are characterised with a lower effectiveness (profitability) per a unit of surface[4].

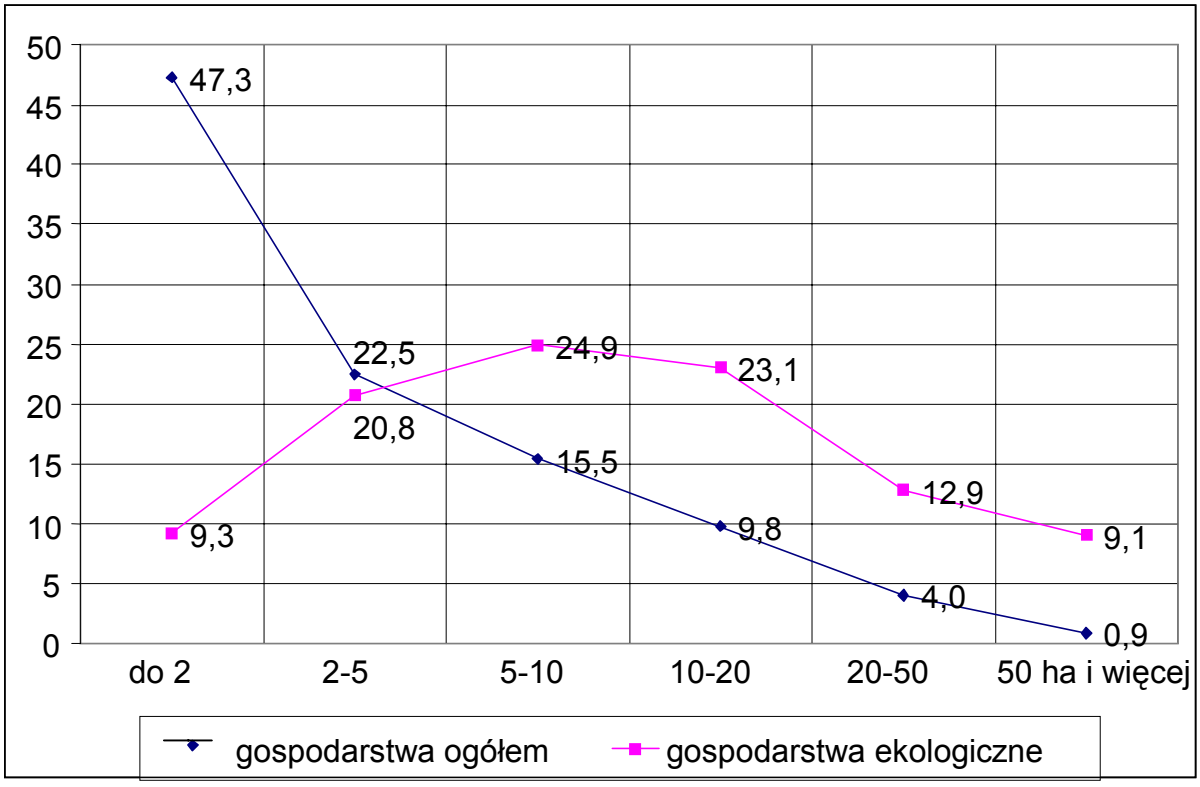
[4] On the basis of the Farm Accountancy Data Network (FADN) for 2004 regarding organic holdings (together with holdings during transferring into ecological principles) and total holdings, it was established that for 1 ha of croplands the value of the agricultural production in the former ones constitutes 75%, and the agricultural income constitutes 70% of analogous categories in the latter population.

Table 1. The number of total holdings (in thousand) and organic holdings (in area groups)

Listing	In total	Area groups (ha of croplands)					
		Up to 2	2-5	5-10	10-20	20-50	-50
The number of holdings							
In total	2 474,5	1 172,2	557,8	383,3	243,4	98,7	21,2
Organic	4 050	375	843	1 010	934	521	369
Structure of the number of holdings							
In total	100,0	47,3	22,5	15,5	9,8	4,0	0,9
Organic	100,0	9,3	20,8	24,9	23.4	12,9	9,1

Source: Charakterystyka gospodarstw rolnych w 2005 r., GUS, Warszawa 2006, tab. 4 and tab. 5.

Drawing 1. Distribution of the number of total holdings and organic holdings by area groups



Source: Worked out on the basis of the data as in table 1.

A greater possibility of combining the ecological and environmental criterion exists in case of holdings with a greater area. Therefore probably there is a relatively greater interest with organic production in such holdings. With a small area of a holding organic production can constitute a rather hobby or supplementary activity. Conducting an organic holding undoubtedly requires greater knowledge, and often also a special life attitude – philosophy of life.

Therefore, it is not surprising that organic holdings are managed by persons with better professional qualifications. This is proved by the percentage of managers with agricultural education. It amounts in case of organic holdings 70%, and in case of total holdings 38%. An even greater differential exists in relation to the university agricultural education. In this case respective percentages amount to 8.2 and 1.2%. However, there are no essential differences in the practical experience, if we adopt as such the period of conducting an agricultural holding.

3. Size and use of lands

Organic holdings have definitely a greater area as compared with the whole population of holdings. In the former the average area of croplands in an average holding amounts to 24.8 ha, while in the latter ones only 6.2 ha, i.e. 4 times less. Visible are also differences in the structure of croplands. In organic holdings the share of permanent grasslands is clearly higher, at the same time the share of arable lands is lower. A little higher is also the share of forests and forest lands, whose area is still about 5 times higher in organic holdings. We can therefore think that those holdings have less beneficial conditions to conduct a typical agricultural production. So it is a good thing that those holdings discount the natural (environmental) conditions for the organic production, while their significant part – also for agrotourism. Organic holdings grow relatively less corns – their share in the structure of crops amounts to 57.2% (in total holdings 74.4%), they sow more lands with spring and winter aftercrops (5.7% of the surface of crops as compared with 2.7% in total holdings[5]) and the percentage of cultivation area for green manure (for ploughing) is almost 12 times greater – 3.5% as compared with 0.3% in total holdings.

4. Livestock of farm animals

Organic holdings are more comprehensive, which is reflected also in the animal production. In particular a greater percentage of those holdings keep farm animals, including especially cattle, sheep, goats and horses. The livestock of farm animals, apart from pigs, is higher in organic holdings. This is justified in the structure of croplands and a frequent conducting of extra-agricultural activity, including in particular agrotourism activity. The livestock density of farm animals – per a unit of the surface area of croplands – is however significantly lower in organic holdings, apart from horses, sheep and goats. This is influenced probably by a well-known regularity of decreasing livestock

[5] The share of spring aftercrops cultivation amounts in organic holdings to 3.8%, and in total holdings 1.7%, while the winter aftercrops cultivation amounts respectively to 1.9 and 1.0%.

density in the course of increasing the area of a holding, limiting the provision with industrial capital goods, including in particular feeds and the structure of croplands (relatively big share of meadows and grazing lands).

Table 2. The area and structure of croplands use in organic agricultural holdings and total holdings

Listing	Area (ha)		Structure (per cent)	
	in total	organic	in total	organic
Total area	7,04	29,10	100,0	100,0
Croplands	6,19	24,85	88,4/100,0	85, 4/100,0
- arable lands	4,77	13,84	77,1	55,7
under crops	4,52	13,29	(73,1)	(53,5)
idle lands and fallows	0,25	0,55	(4,0)	(2,2)
- orchards	0,12	1,10	1,9	4,4
- permanent meadows and grazing lands	1,30	9,91	20,0	39,9
Forests and forest lands	0,44	2,35	6,2/-	8,1/-

Source: As in table 1.

Table 3. Livestock of farm animals in agricultural holdings conducting agricultural activity

Listing	Holdings keeping (per cent)		Livestock of animals (pieces)					
			per 1 holding (A)		Per 100 ha UR		per 1 holding (B)	
	in total	organic	in total	organic	in total	organic	in total	organic
Cattle	31,6	58,3	2,2	6,7	35,8	27,0	7,0	11,5
- cows	29,5	55,8	1,2	3,4	18,8	13,7	4,0	6,1
Pigs	28,3	35,4	7,2	6,3	115,6	25,4	25,2	17,8
Sheep	0,6	7,6	0,13	5,23	2,1	21,1	20,2	68,8
Goats	0,2	7,4	0,02	0,85	0,3	3,4	2,7	11,4
Hen poultry	52,2	58,4	53,2	60,5	860,7	243,4	102,0	103,6
Horses	6,4	18,5	0,6	1,0	2,0	4,0	1,9	5,3

A – all holdings; B – only holdings keeping a given kind of animals. *Source: As in table 1.*

5. Sources of income of households (families)

In this case we limited ourselves of course to individual holdings, in which organic methods of agricultural production are used (3998 holdings). In the GUS statistical research in order to classify a household to the social and economic group the source of the prevailing income is taken into account, i.e. the origin of over 50% of the total (general) income of such holding. This income consists of joint incomes of all persons living together with the user of an agricultural holding and earning their living together with him. The publications based on the data of the national census distinguish the following aggregates of sources of income: agricultural activity, agricultural activity and hired work, hired work, hired work and agricultural activity, own extra-agricultural activity, retirement pays and pensions, other non-earned sources apart from retirement pays and pensions, and other. Here we are interested with the distribution of the number (structure) of holdings on account of the prevailing source of income. We will present these holdings against the background of the total individual holdings.

Organic holdings almost twice more often than total holdings earn their living from agricultural activity understood as the prevailing income. Such source of income prevails in over half of the organic holdings and a little more than 1/4 of the total individual holdings. Explanation of such situation is mainly in the area of croplands. In the whole population individual holdings earning their living from agriculture have 2.4 times greater area of croplands in relation to the area of an average holding (13.22 ha as compared with 5.55 ha). The area of croplands of an average organic holding is 4.5 times greater than an average holding in the whole population of individual holdings (24.85 ha as compared with 5.55 ha). Unfortunately, we do not have data on the average area of croplands of organic holdings earning their living from agriculture. We can, however, taking into account the distribution of total holdings and organic holdings by area groups, think that it is much bigger, however the modal value of organic holdings is in the area group of 5-10 ha (in case of total holdings – in the group of 0-1 ha).

A greater frequency of organic holdings earning their living from agriculture than the total holdings seemingly paradoxically is followed by a higher percentage of holdings achieving income from an economic activity other than agricultural activity (respectively 17.5% in the group of organic holdings and 5.4% in total holdings). The advantage of organic holdings in this scope is not limited only to agrotourism (respectively 8.6 and 0.4%), but it is also present in case of other kinds of extra-agricultural activity. The agrotouristic activity is connected probably with a higher percentage of holdings selling at least 50% of the commodity production directly to

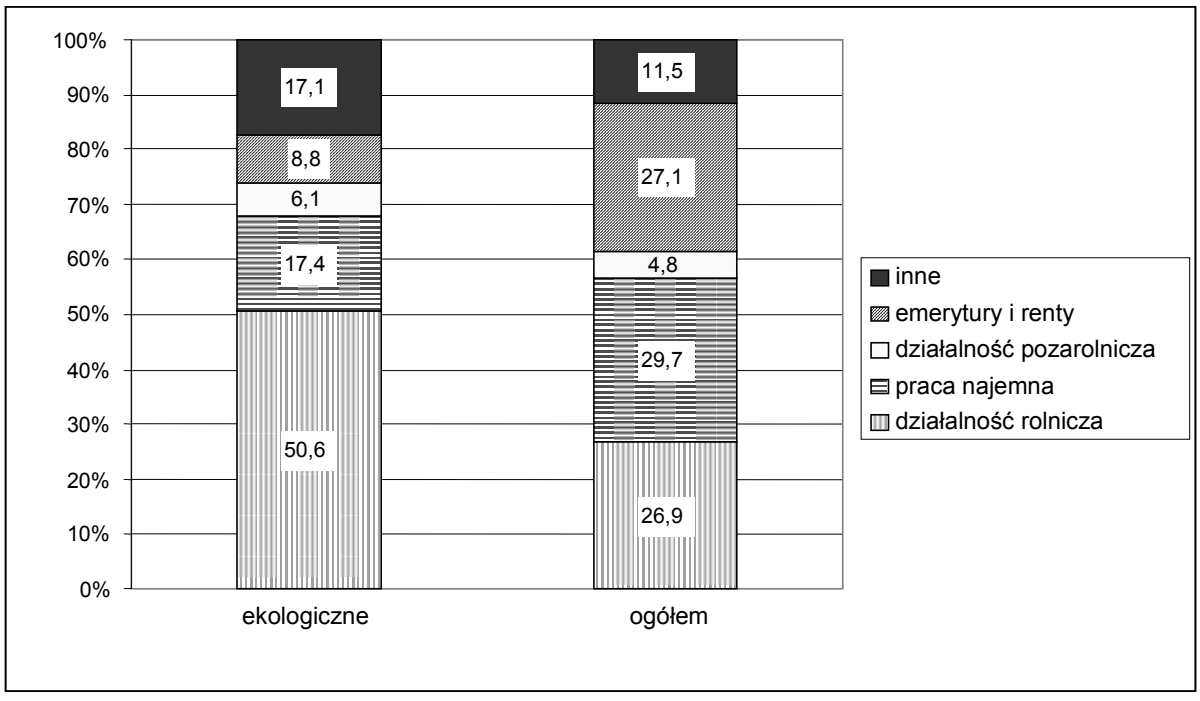
consumers among the organic holdings (26.1 as compared with 14.8%). Also an observation is interesting that among organic holdings the frequency of families earning a prevailing income from hired work or social benefits (retirement pays and pensions) is clearly smaller.

Table 4. The number and structure of individual holdings – organic and total by the prevailing source of income

Listing	Number		Structure	
	organic	in total	organic	in total
In total	3 998	2472830	100,0	100,0
Agricultural activity	2 024	664 216	50,6	26,9
Agricultural activity and hired work	51	18 551	1,3	0,8
Hired work	697	734 780	17,4	29,7
Hired work and agricultural activity	173	68 419	4,3	2,8
Extra-agricultural activity	243	119918	6,1	4,8
Retirement pays and pensions	350	669 086	8,8	27,1
Other non-earned sources	24	36 555	0,6	1,5
Other	437	161 304	10,9	6,5

Source: Worked out on the basis of data: Charakterystyka..., op. cit., tab. 6.

Drawing 2. Structure of the number of organic individual holdings and total individual holdings by the prevailing source of income



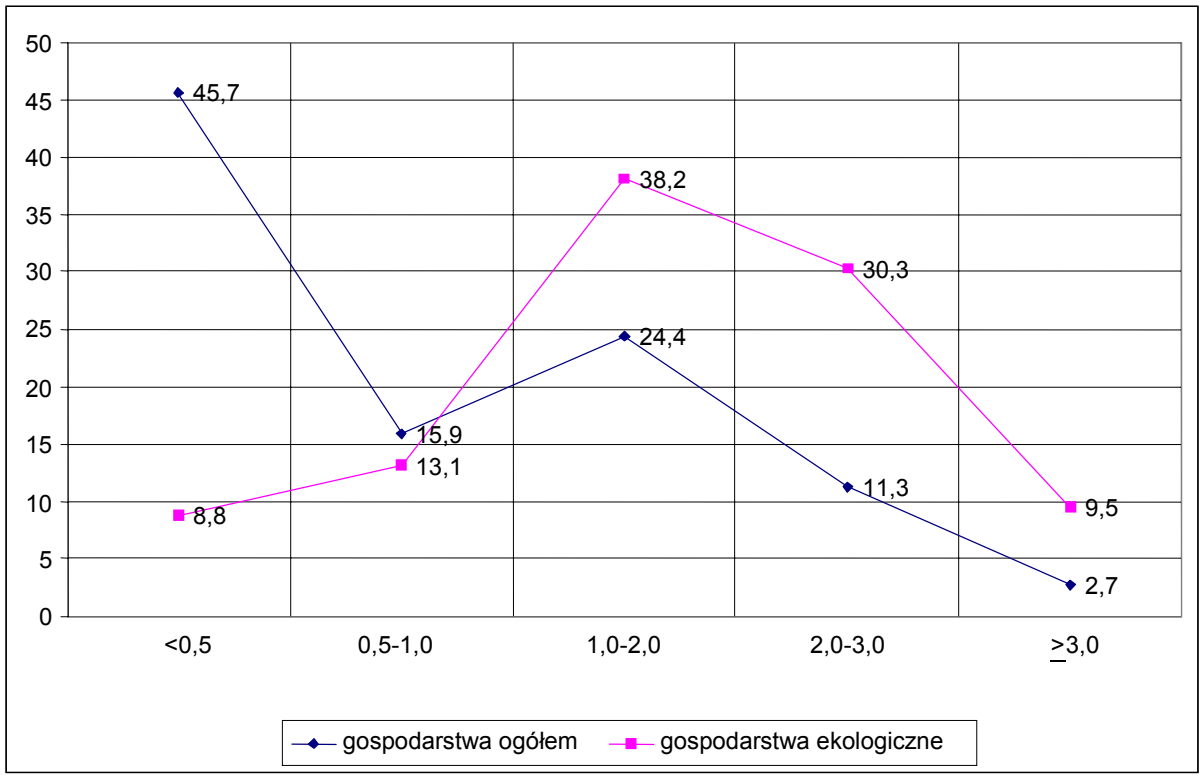
Source: Worked out on the basis of data as in table 4.

6. Work inputs

Spending work inputs for agricultural activity is an essential feature diversifying agricultural holdings. The available data enable to establish the work inputs – per standard units of persons working full-time (JPZ) – equal to spending 2120 hours a year – together for a family, hired workers and neighbours' help. Here the subject of analysis are two issues. The first one concerns the structure of holdings by the size of work inputs, and the other – the size of those inputs per 100 ha of croplands. We will also refer to the universal view that organic holdings engage more work inputs, which is significant in conditions of large amounts of unused resources of work in families connected with agriculture. We should also take into account the fact that such situation – connected first of all with the fragmented agrarian structure – has a bit different dimension in relation to holdings with a greater area.

The structure of total holdings and individual holdings in terms of work inputs practically does not differ, while in relation to organic holdings there are insignificant differences – mainly in the group of holdings with the largest work inputs.

Drawing 3. The structure of individual holdings by the size of work inputs (JZP)



Source: Worked out on the basis of data in table 5.

However, there are visible differences in the structure of total holdings and organic holdings according to the size of work inputs. In relation to individual holdings this was illustrated in drawing 3.

Table 5. The number[a] of agricultural holdings in total and organic holdings in groups of amounts of work inputs per holding (JZP)

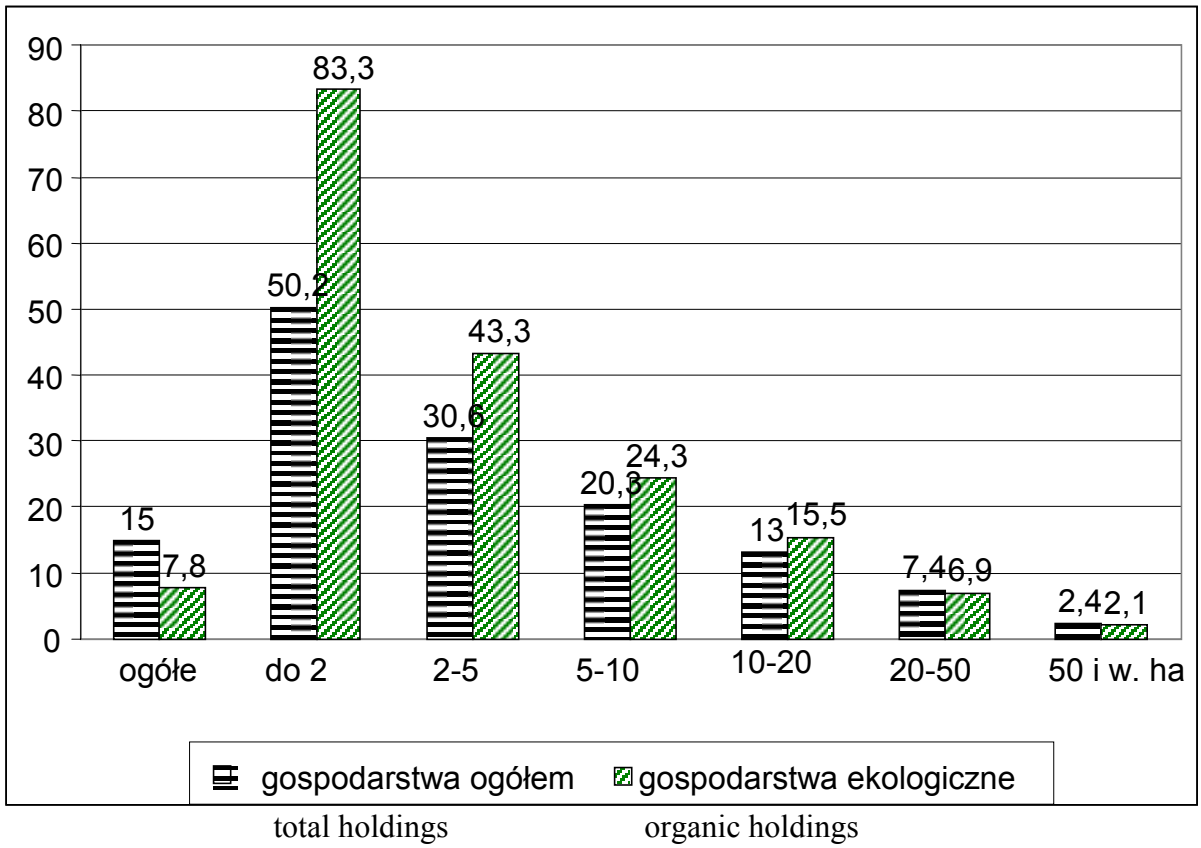
Listing	In total	Work inputs (JZP)				
		Up to 0,49	0,50- -0,99	1,00- -1,99	2,00- -2,99	3,00 and more
Holdings in total	2 476,5	1 130,5	393,5	605,0	279,3	68,2
including: organic	4 050	352	528	1 530	1217	423
Individual holdings	2 472,8	1 130,3	393,0	604,4	279,1	66,0
including: organic	3 998	352	523	1 529	1213	381

[a] in case of total holdings the data was given in thousands with one decimal place, while in case of organic holdings it was given in units (pieces) *Source: Charakterystyka..., op. cit., tab.8.*

Organic holdings engage greater work inputs, which undoubtedly in the conditions of surplus of work resources can be an advantage, if however they are paid on an approved level. It is difficult to establish the level of such approval, because it will be different in case of marginal work resources, and different in case of work that is supposed to provide a basic source of income. However, as it seems, differences in work inputs result not from a higher work-consumption of production in organic holdings, but rather from a several times greater area of organic holdings, which means a greater production. It turns out that the level of work inputs per an area unit of croplands is over twice bigger than in total holdings – on account of a greater fragmentation of the area structure.

If we eliminate the influence of the area on the size of work inputs by establishing them for comparable area groups, the picture looks different. In comparable area groups the level of work inputs per an area unit is higher in organic holdings, however this does not concern greater holdings (last area groups). This is illustrated by drawing 4. What are the reasons? Some function can be played here by a certain extensification of production after exceeding a certain area of a holding, as compared to the family workforce barrier, as well as a more frequent phenomenon of holdings of a residential character or purchased for speculation purposes among the total holdings. This issue requires a more detailed analysis in order to reach „hard" conclusions, which however is prevented by the available data. The situation in this scope can be partly clarified by an analysis of the structure of croplands usage and the livestock density of farm animals.

Drawing 4. Work inputs in the area groups (JZP per 100 ha of croplands)



Source: Worked out on the basis of data: Charakterystyka…, op. cit., tab. 5 and tab. 8.

Total holdings are characterised – on average – with a high share of corns, exceeding the requirements of good agricultural practices, as well as a higher share of industrial plants. Organic holdings grow relatively more soil-grown vegetables and strawberries.

The intensity of animal production is lower in organic holdings, which is proved by a lower livestock density of pigs and poultry, while the livestock density of cattle, sheep, goats and horses is higher. This is determined by a greater orientation to agrotourism, direct sale and self-supply of healthy food. Organic holdings have more diversified flock of farm animals. The percentage of holdings keeping cattle in total holdings amounts to 32%, and in organic holdings it amounts to 58%. Analogous data in case of cows amounts to 29 and 56%, in case of pigs – 28 and 35%, sheep – 1 and 8%, goats – 2 and 7%, hen poultry – 52 and 58% and horses – 6 and 19%.

7. Holdings of selected area groups

The cognitive value of the comparative analysis of economic relations in organic holdings and total holdings is limited by significant differences in the scope of the area of these groups of holdings. This problem can be eliminated by comparing groups of holdings with a similar area, i.e. analogous area groups. We have taken for comparison two area groups, namely the group with an average agricultural holding (5-10 ha) and the group with an average organic holding (20-50 ha).

Table 6. Usage of lands in total holdings and organic holdings in selected area groups

Listing	Area group 5-10 ha				Area group 20-50 ha			
	in total		organic		in total		organic	
	ha	per cent[a]	ha	per cent[a]	ha	per cent[a]	ha	per cent[a]
Total area	8,22	100,0	9,06	100,0	31,42	100,0	35,89	100,0
Croplands	7,12	86,6	7,36	81,2	28,80	91,7	30,78	85,8
- arable lands	5,26	73,9	4,07	55,3	22,46	78,0	14,65	47,6
under crops	4,99	94,9	4,03	22,0	22,08	98,3	14,06	96,0
- permanent meadows and grazing lands	1,63	22,9	2,65	36,0	6,08	21,1	14,99	48,7
Forests and forest lands	0,67	×	1,19	13,1	1,46	4,6	2,88	8,0

[a] the area of croplands, forests and forest lands was referred to the total area, the area of arable lands, permanent meadows and grazing lands was referred to the area of croplands, while the area under crops was referred to the area of arable lands. *Source: Charakterystyka..., op. cit. 4 and 5.*

Table 7. Share of selected crops in the crops structure of the selected groups of holdings

Crops	Area group 5-10 ha		Area group 20-50 ha	
	in total	organic	in total	organic
Corns	79,0	62,1	74,2	58,9
Industrial	2,7	0,9	7,7	1,1
Potatoes	6,8	7,2	3,9	2,4
Soil-grown vegetables	1,9	2,3	1,1	1,3
Strawberries	0,7	2,6	0,2	0,9

Source: Charakterystyka..., op. cit. 4 and 5.

Table 8. Livestock of farm animals in the selected groups of holdings (pieces per 1 holding)

Listing	Area group 5-10 ha		Area group 20-50 ha	
	in total	organic	in total	organic
Cattle	2,5	3,8	15,2	10,5
including cows	1,4	2,1	7,8	5,0
Pigs	8,1	4,2	43,7	7,1
Sheep and goats	0,2	1,9	0,8	11,1
Hen poultry	53,2	36,7	149,7	31,8
Horses	0,2	0,5	0,3	2,2

Source: Charakterystyka..., op. cit. 4 and 5.

The first area group covered 383,265 total holdings (15.5% of holdings) and 1010 organic holdings (24.9% of organic holdings), while the second group covered respectively 98,665 (4.0%) and 521 (12.9%) holdings. In case of both area groups a small advantage in terms of the area was on the side of organic holdings. The total area of holdings in the area group 5-10 ha amounted to 8.22 ha, including 7.12 ha of croplands, while in case of organic holdings – respectively 9.06 and 7.36 ha. The analogous data for holdings of the area group of 20-50 ha amounted to: 31.42 and 28.80, 35.89 and 30.78 ha.

Two features of organic holdings in the scope of land usage are most visible in case of both area groups, namely: a higher share of forests and forest lands in the total area (and lower share of croplands), and a significantly higher share of permanent grasslands in comparison with the total agricultural holdings. However, in the scope of the crops structure organic holdings are characterised with a lower share of corns – on average they meet the requirements of the good agricultural practice (below 66%) and of industrial plants. However, the share of soil-grown vegetables and strawberries, which are significant for work resources consumption and incomes, is higher.

Organic holdings in the lower area group (5-10 ha) are characterised with a higher livestock of farm animals more connected with arable lands, i.e. cattle, horses, sheep and goats. In case of the higher area group (20-50 ha), this advantage has decreased only in relation to horses, sheep and goats. Lets us mention that the percentage of holdings keeping sheep, goats, hen poultry and horses is higher for organic holdings in both selected area groups, but it is lower in case of pigs, while in case of cattle (including cows) it is higher in relation to organic holdings in case of the first selected area group and lower in case of the second selected area group.

To supplement the characteristics of the selected area groups we will also quote the data in the scope of the agricultural education of users, work inputs and economic activity – against the background of total holdings. The comparison of groups of organic holdings and non-organic holdings in relation to the agricultural education and resources of work inputs shows multilevel differences between the lower and higher area group. However, the system of those differences is clear in the scope of the economic activity, and to be more precise, the percentage of holdings achieving incomes from the non-agricultural activity, benefiting from the agricultural consultancy and associated in producer organizations, which should be stressed.

Table 9. Selected data on total holdings and organic holdings

Listing	All groups		Group 5-10 ha		Group 20-50 ha	
	in total	organic	in total	organic	in total	organic
Percentage of holdings with the user's agricultural education						
With agricultural education	38,5	69,9	54,4	71,4	75,6	69,3
University degree	1,2	8,2	1,4	7,8	2,8	
Secondary vocational and vocational college	6,4	17,3	8,5	13,2	20,3	
Basic vocational	8,7	11,5	14,0	13,1	25,8	13,2
Agricultural training course	22,2	32,8	30,5	37,3	26,7	29,4
Work inputs (JPZ)						
Per 1 holding	0,92	1,93	1,42	1,78	2,10	2,11
Per 100 ha UR	16,2	7,8	20,3	24,3	7,4	6,9
Percentage of holdings						
Selling directly >50% of their production	14,8	26,1	17,4	30,4	11,7	18,4
Benefiting from the agricultural consultancy	23,7	82,5	38,6	87,1	72,7	90,4
Associated in producer organizations	1,5	13,7	2,2	12,3	7,2	12,9
Achieving incomes from non-agricultural activities	5,4	17,5	6,0	16,2	6,9	24,0
Achieving incomes from agrotourism	0,4	8,6	0,5	7,1	0,6	9,2

Source: Charakterystyka..., op. cit. 4 and 5.

8. Organic holdings in the concept of sustainable agriculture

It is generally believed that the Polish agriculture creates safe (healthy) food products in an environment-friendly way. Generally the non-polluted or little polluted soils and traditional technologies are stressed then, as well as the environment-friendly organization of production (way of management). This is first of all connected with the fragmented agrarian structure of individual agriculture, constituting a dominant form of agriculture. A peculiarity of the structure of Polish agriculture is a huge number of holdings satisfying only and mainly their own needs, with a relatively small number of holdings with a significant commodity production. But this does not determine the sustainability of a holding. The data of the structural research show that a significant part of individual holdings does not meet the environmental criteria of sustainable agriculture[6]. In relation to the livestock density of farm animals per 1 ha of croplands, only 2.5% of individual holdings exceeds the norm (2 SD/1 ha UR), and in case of ruminants (cattle, horses, sheep, goats) the criterion is not met by 56% of holdings. The advancing concentration of animal breeding, to a significant extent based on the purchased feeds, makes itself felt here. Around 3/5 of holdings infringe the norm of at least 3 spieces in the crop rotation and around 2/3 of holdings infringe the norm in the scope of the share of corns. The criterion of at least 33% of arable lands covered by winter plants is met by 36% of holdings. If we take into account at the same time all the mentioned criteria, they are met by 1.3% of holdings (32.6 thousand), which is not many. Almost 1/4 (24%) of individual holdings meets the criterion of the economic vitality, if it is assumed as achieving income from an agricultural holding constituting a basis to support a family (>50% of the total income of a household) and creating opportunities of spending the work inputs in the amount of at least 1.5 JPZ. The selected criteria of sustainability do not cover the level of mineral fertilization and pesticides usage, which is extremely essential for sustainable agriculture, however the level of usage of those agents is relatively small in Poland, so it does not threaten the environment. Of course the norm can be exceeded locally (in an agricultural holding, on a given field or for a given crop), however they do not have any effect on the whole picture.

[6] This is about the criterion of the share of corn (≤66%), the number of species in crop rotation (≥3), the share of surface covered with plants in winter (≥33%), livestock density of ruminants SD/1 ha GPP (≤1,5) and the livestock density of farm animals SD/1 ha UR (≤2). See more W. Wilk: *Koncepcja wykorzystania danych rachunkowych FADN do ustalenia stopnia zrównoważenia gospodarstw rolnych,* [in:] Koncepcja badań nad rolnictwem społecznie zrównoważonym. Collective work edited by J. St. Zegar, Program Wieloletni, Raport nr 11, IERiGŻ-PIB, Warszawa 2005, page 145.

Against this background organic holdings constitute a very interesting population, because according to the assumption they create dangerous food products in an environment-friendly way. They undoubtedly constitute a perspective form of sustainable agriculture.

9. Conclusion

The analysed data published by GUS concerning the structural research of agricultural holdings at the beginning of accession to the European Union enable to formulate a number of observations and conclusions.

First of all, a greater tendency for organic production is shown by users of agricultural holdings with a higher level of formal education, larger families (able to have greater resources of work), more oriented at earning their living from the agricultural activity, and first of all with a greater - and at the same time more naturally diversified – area of a holding. This diversification causes bigger opportunities for extra-agricultural activity within a settlement, while the area of a holding has a significance for ensuring the source of income for the family by the agricultural activity. Undoubtedly a significant meaning apart from the economic calculus probably has the farmer's avocation and attitude towards the nature. Therefore, while making production decisions – apart from the motif of the economic benefit – some role is played by the motif of non-economic benefits. This in particular concerns family (peasant) holdings. The existence of the second motif creates an opportunity for the organic agriculture. Establishing the meaning of this motif, however, requires separate analyses, including also sociological analyses.

Second of all, the conducted initial overview of groups of organic holdings and the remaining holdings with a similar area of croplands indirectly shows some advantage of the second ones in the scope of production and economic indexes, however this is not a „shocking" advantage. However, taking into account the purchase of capital goods of industrial origin, the situation can look different in the scope of pressure on the environment (the so called „footprint"). Introducing a variable relating to this pressure to the economic calculus or by certain ecological requirements (according to the polluter pays principle) or the payments for public goods and services, can significantly change this advantage. This issue requires a closer analysis.

Third of all, the population of organic holdings *ex definitione* oriented at the agricultural activity shows a fundamental difference in terms of the area structure in relation to the population of other holdings. The latter contains a huge number of agricultural holdings in formal and legal terms, in the form of garden plots, sometimes with very small production, often with insignificant

interest in the agricultural activity (probably even limited to meeting formal requirements in order to achieve area payments). Therefore comparing the holdings of the two populations is very „polluted" with differences in the area and social structure.

Fourth of all, the requirements of the food industry clearly prefer the products of industrial agriculture, i.e. holdings with a large scale of production, that can provide greater batches of homogeneous and cheaper products. In this competition organic holdings have smaller opportunities, and therefore will lose competition, unless they manage to create separate networks connecting them with the consumer (commercial and processing networks).

Fifth of all, the conducted overview of holdings indicates a possibility of combining the production and economic criteria with the environmental criteria, which, however, statistically speaking, requires a far greater natural potential of a holding than it is true at present in relation to the dominant mass of agricultural holdings. Therefore the orientation on a model of organic holdings requires a faster concentration of land than it is true in case of conventional holdings. However, in this case there is a significant difference – in case of organic holdings there is the upper limit of this concentration, which is not true in case of conventional holdings. Moreover, the desired pace of concentration in both cases will be different (lower), if we take into account the social criteria of agriculture. Therefore, there can be a situation that an organic holding will not be a socially sustainable holding.

Sixth of all, there is an obvious conclusion of the need of further analyses with the use of more developed statistical and economometric methods, based on the unit data. Such analyses will be undertaken both on the basis of the GUS data, as well as the FADN data.

Seventh of all, the possibilities of a greater use of the solar energy in creating biomass, with the use of the natural laws, needs to be recognized, without limiting at the same time to genetics, however, giving up the use of chemical and synthetic substances. The idea is to direct the scientific research not on creating an artificial world, but on further getting to know to Nature. The knowledge gathered in this way, together with the system of values, will lead to Nature-friendly agriculture – organic agriculture. We do not have to passively copy the path followed by more developed countries. As Aristotle used to say – even God is not able to change the past, but we can shape the future.

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