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From the research on socially-sustainable agriculture (34)

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THE POLISH AND THE EU AGRICULTURES 2020+
CHALLENGES, CHANCES, THREATS, PROPOSALS

Warsaw 2015

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Global and national conditions of the sustainable development of agriculture
Economic assessment of external effects and public goods in agriculture
Sustainable agriculture and food security

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Foreword

The Multi-Annual Programme entitled *The Polish and the EU agricultures 2020+. Challenges, chances, threats, proposals*, established pursuant to the Resolution of the Council of Ministers of 10 February 2015, to be implemented by the Institute of Agricultural and Food Economics, National Research Institute (IAFE-NRI) in Poland in years 2015-2019, covers among 8 research topics, the issue of *Dilemmas of the development of sustainable agriculture in Poland*. Within this topic, three research tasks have been distinguished, namely (1) Global and national conditions of the sustainable development of agriculture, (2) Economic assessment of external effects and public goods in agriculture, (3) Sustainable agriculture and food security.

The first chapter concerns reasons and conditions for the sustainable development of agriculture and rural areas. The need for orientation of agricultural development to the model of sustainable agriculture stems from numerous reasons, e.g. deficiencies of the model of industrial agriculture, demand for new goods and services provided by agriculture, food security, social cohesion, challenging the existing formula of progress. Although the reasons for sustainable development are evident, the direction towards sustainability of agriculture not necessarily becomes a reality – it depends on many conditions. These conditions are diverse and they can be grouped into three main blocks, e.g. environmental, economic and social, appropriately to sustainability orders. The discussion presented in this chapter ends with an identification of these sustainable development problems, which will be the subject of further research. Prof dr hab. Józef Stanisław Zegar is the author of the first chapter.

The second chapter concerns productivity and profitability. The purpose of this study is to compare selected groups of farms characterised by the use of environmentally friendly agricultural practices. The analysis uses data from 2012 on individual commercial farms included in the Polish FADN. The used test method does not include externalities. However, the results show that the level of productivity and profitability could encourage farmers to introduce agricultural practices considered to be environmentally-friendly and sustainable. The author of the second chapter is Dr Konrad Prandecki.

The third chapter presents the problem of food security, which occupies more and more space in the debate on the future of the Common Agricultural Policy after 2013. European Parliament resolution of 18 January 2011 on recognition of agriculture as a strategic sector in the context of food security evidence of this. One of the dimension of food security is the economic food availability.

Economic availability of food at the household level is measured by many indicators. The indicators used by Food and Agriculture Organization of the United Nations are: the level of income, Gini coefficient, the total expenditure, expenditure on food, the share of food expenditure in the total expenditure, food prices. These indicators are the basis of research to identify problems in the area of economic availability of food, which include: the national food consumption analysis, research on expenditure on food, assessment of the level of poverty and living standard of population.

In Poland, incomes and prices are the most important factors influencing food consumption. Both of these factors determine economic availability of food. Empirical research showed that the economic availability of food in Poland is stable. However, in households 20% of the poorest people degree of satisfaction of food needs was unsatisfactory. Dr hab. Mariola Kwasek is the author of the third chapter.

Chapter I

PREMISES AND CONDITIONS OF THE SUSTAINABLE DEVELOPMENT OF AGRICULTURE AND RURAL AREAS

Introduction

Research and analyses to date have indicated that agriculture, which has been at a crossroad, requires a new development paradigm [Zegar 2012a]. The question is, first of all, what model of agricultural development will prevail in the foreseeable future. Models of agriculture, which there are quite a few, have changed over the centuries. At present, a model of industrial agriculture (also known as a conventional model) prevails in developed countries, while various forms of traditional agriculture are typical of developing countries, i.e. of the world as well. In the last decades of the 20th century, representatives of mainstream economic and social thought formulated a thesis that agriculture of developing countries inevitably follows a trail set by agriculture of developed countries, i.e. the trail of industrial agriculture. Currently, this thesis is challenged and a view that necessitates orientation to sustainable agriculture, whose model is still developing, is increasingly popular. Both industrial agriculture undergoing transformation and agriculture of developing countries are progressing towards such a model. This chapter addresses only basic models of agriculture, i.e. industrial and sustainable agriculture. They are characterised in Section 1.

The need for orientation of agricultural development to the model of sustainable agriculture stems from numerous premises that are presented in Section 2. Choosing to follow the direction towards sustainability of agriculture – recognising it as the right one – is yet not enough to determine the actual trajectory of development. Not everything that is desirable and right to do is possible. Even the most legitimate ideas rarely become a reality. Development – any development – takes place under specific conditions, specific "pressure of reality" that may hinder or even prevent it from following the desired trajectory. These conditions are different in nature and, for research purposes, it is convenient to group them into environmental, economic and social conditions *per analogiam* to sustainability orders. The most important environmental conditions are those related to soil, water, biodiversity, climate and mineral resources. As regards economic conditions – those related to economic growth, the progressive liberalisation of product, service and capital (financial) markets as well as corporate domination. In turn, crucial social conditions include a cultural system, consumerism and externalities. Section 3 is devoted to conditions for the development of sustainable agriculture.

In general – and not without a reason – agriculture and food production as a whole are typical of rural areas. Although the latter is also carried out in urban areas and even it is getting more and more popular in megacities, while a significant and important food segment is sourced from seas and oceans, the fact referred to above is irrefutable. Rural areas prevail when it comes to management of physical space and ecosystems. Their population accounts for nearly half of the world's population. Therefore, interest in the sustainable development of rural areas, more specifically rural localities, is understandable. This issue is discussed in Section 4.

The chapter ends with a brief summary and identification of sustainable development problems that will be the subject of further research on global and domestic conditions for the sustainable development of agriculture and rural areas. The presentation refers to the macro scale, i.e. the planetary (global) scale, although it can also be referred to the country (Poland).

1. Models of agriculture – industrial and sustainable

The term "model of agriculture" is construed as a method of agricultural production with specific features that make it distinguish from others. It is all about relations with the natural environment, in particular the way natural resources are used, production technologies and applied working tools, production organisation and social relations, i.e. with other social groups. Without going into much detail on classification of models of agriculture, only two of them, which are the most distinctive at present, will be discussed, namely the model of industrial agriculture that prevails in developed countries and the emerging model of sustainable agriculture that has several shapes (forms).

The former is a product of agricultural industrialisation which, in synthetic terms, covers five phenomena, namely: 1) intensification of agriculture by using industrial means of agricultural production (chemical fertilisers, plant protection chemicals, tractors, harvesters and other agricultural machinery, industrial fodder, veterinary products, etc.), resulting in outflow of labour force from agriculture as well as land and labour productivity growth; 2) concentration of production potential (of land and capital) and production (size of crops and herds of livestock, the scale of production); 3) specialisation of holdings and regions as a whole (holdings without livestock, animal farms as well as vegetable, orchard, cereal and dairy regions, etc.); 4) commercialisation, namely market orientation, while reducing production self-supply (seed, seed potatoes, fodder, fertilisers) and consumption self-supply (products consumed in households) and 5) financialisation – encouraging a profit/income motive and making agricultural holdings more dependent on finance (credits, insurance, financial burdens, cash

flows). Agricultural industrialisation, which had its origins in Western European countries in the 18th century, was driven by socio-political, technological (scientific and technical progress) and economic changes. Its golden era began in the second half of the 20th century.

Socio-political changes were (and still are) associated with the rise of capitalism which, for its own purposes (mostly maximisation of capital accumulation), sought to establish a class of wage-earners (proletariat) and provide cheap food for rapidly growing urban areas and the working class. Demand was shaped by rapidly growing population, in particular urban and non--agricultural population, as well as an improvement in its nutritional status, including eliminating the age-old scourge of famine, and also by raw material needs of certain industries. Demand boosted agricultural production growth that was to be achieved by modernising and transforming agriculture, involving the formation of highly mechanised and specialised large-scale agricultural enterprises with high labour productivity, but also with high capital intensity, using the social division of labour and pursuing production based on industrial means of agricultural production, i.e. fertilisers, plant protection chemicals, technical means, industrial fodder, growth stimulants, veterinary medicines, genetic innovations, as well as by incorporating agriculture into the vertical integration of the food economy. Previously existing large feudal ownership was transformed into modernised capitalist agricultural enterprises and supported by both enterprises emerging from a class of wealthier peasants and those newly established on the ruins of declining peasant holdings. Capitalism was aimed at eliminating the peasant economy, just like socialism that emerged in some places. It was reflected in the agricultural (agrarian) question formulated in the late 19th century. The transformation of the peasant economy consisted in concentration, specialisation, mechanisation, intensification and commercialisation. This path is known as the transition from a peasant to a farmer (agricultural entrepreneur) [Tomczak 2005].

Technological changes are reflected by the widespread application of technical and industrial means of agricultural production that created ground for concentration as well as upscaling plant and animal production (breaking links between fodder and fertilisers), with the far-reaching specialisation and separation of plant and animal production and also increasing the integration of agricultural enterprises with agribusiness environment, mostly making holdings dependent on non-agricultural segments of the food economy. By making agriculture more motorised and mechanised, technical means created technical conditions for labour productivity growth, as human labour inputs were replaced by increasingly advanced agricultural machinery and tractors. This contributed

to a shift of significant labour resources from agriculture to non-agricultural sectors with higher productivity, thus actually creating demand for food. Thanks to technical means, the scale of production – previously limited by labour resources – could be increased, while labour productivity multiplied. Furthermore, agricultural products that were previously used as fodder for draft animals were made available due to tractors and engines that displaced live draft force. They could be used for other livestock or other purposes. In turn, chemical fertilisers allowed for achieving much higher crop yields than those obtained by using natural soil fertility only, while crop protection chemicals decreased slightly loss due to pests and diseases. Moreover, biological progress that allowed for improving the ability of plants and animals to effectively absorb natural and artificial means of agricultural production, organisational and technical progress in the form of production concentration and specialisation as well as transport and communication progress that made the transportation of agricultural products over long distances possible, which was crucial for trade and competition development, played a huge role in the modernisation of agriculture. What is more, agricultural production was getting more intensive due, in general, to putting capital-intensive production techniques in place. To sum up, industrialisation was accompanied by the implementation of technical, agronomic and genetic advances at once by agricultural holdings, while technological changes enabled a simultaneous improvement in land and labour productivity which, in material terms, could be reflected in the phrase of *cheap and abundant food* referred to industrial agriculture.

Economic changes were related to the development of capitalism as well. It was all about demand for labour force for growing industry, mining, transport and other non-agricultural sectors and also increased demand for money in both large ownership and peasant holdings that were undergoing modernisation. The move of labour force from agriculture to non-agricultural sectors, especially industry, was beneficial for boosting economic development. This is expressed most synthetically by the well-known Lewis Dual Sector Model[1].

On the other hand, agricultural commercialisation made farmers more driven by profit (income) and was both a premise for and a consequence of the

[1] This model assumed that the economy is split into two sectors only: a traditional one (agriculture) and a modern one (industry). Since marginal labour productivity in the traditional peasant economy equaled zero and labour productivity in growing industry was relatively high, the move of labour force from agriculture to industry directly led to economic growth. In other words, excessive labour force in agriculture due to agrarian overpopulation practically did not create value added, namely GDP, so that its use in industry directly translated into GDP growth. First, it was just about excessive labour force, and later – about agricultural labour force released thanks to agricultural industrialisation [Zegar 2012a].

modernisation of the industrial peasant economy. The growing importance of external means of production along with cultural changes of agricultural families (willingness to follow an urban consumption model) increased demand for money. In a competitive market, it forced labour productivity growth and the concentration of the potential *eo ipso* of agricultural production. Specialisation served the same purpose, following principles of reductionism and Fordism. Self-supply was no longer the main motive of family agricultural holdings, where only surplus production used to be earmarked for sale or paying taxes and contributions. They started to be money-driven, or more precisely – profit--driven. The profit motive is a powerful stimulus for numerous changes in agricultural practices. This applies in particular to: 1) increasing production potential (of land and capital), 2) changing the structure of potential (including expansion of arable land at the expense of ecological land, land productivity growth through land reclamation, an increase in the livestock herd size); 3) intensifying farming by applying industrial means; 4) increasing progress absorption (rationalisation of applying industrial means, production potential, improvement of plant and animal varieties). Unfortunately, the economic equilibrium reached at the level of maximum profit did not take account of the balance of the ecological system and the social system [Woś and Zegar 2002]. This was due to transformations in the social system of values adequate to the free-market model and changes in agricultural production technique that involved making the agricultural production apparatus more capital-intensive and less labour-intensive.

The scale of production began to outgrow the traditional framework of peasant holdings that began their evolution towards family farms and then agricultural enterprises. The orientation towards marketing their products made agricultural holdings included in the system of vertical integration. Paradoxically, farmers, in spite of increasing production capacity and the scale of farm production, were more and more losing their freedom of decision to agricultural environment operators. Concentration, specialisation and standardisation in agriculture were stimulated (even enforced) by intermediaries and food processors, but only for the sake of their own interests. Under overproduction conditions, dispersed and economically weaker farmers had no chance to impose their requirements on the agricultural market and were increasingly forced to submit to stronger players on the market. As a result, these were those players that benefited most from the processes.

Concentration processes took place also in agricultural environment. This directly led to vertical integration – formation of agribusiness that became a metasystem in relation to agriculture, subordinating it to own interests. There

were countries in which farmers tried to strengthen their position through – in addition to concentration – cooperation (horizontal integration), including the creation of cooperatives of different types. However, they usually failed to significantly strengthen their position, because concentration and consolidation occurred and continue to occur in the main links of the agribusiness chain as well – even faster than in agriculture. Furthermore, leading forces change: local and national enterprises were displaced by transnational corporations – industrial and commercial ones.

Material and socio-economic changes were accompanied by significant cultural changes. An industrial mentality appeared (agriculture as a profession, demystification of land – it was no longer treated as sacred – and an agricultural holding, and mainly focus on marketability of production). This gave direction and importance to the motive of microeconomic benefits that were limited to an economic category referred to as profit, leaving traditional existential and psychosocial motives aside.

Apart from demand, the absorption of agricultural labour force released by agriculture and the development of industries associated with agriculture and processing agricultural raw materials as well as agricultural trade and services, which took over many tasks (works) of agricultural holdings, were of particular importance at the macroeconomic level. At that time, the development of industry and other non-agricultural sectors of the economy was actually labour--intensive, resulting in the fact that labour force was – using economic jargon – sucked from agriculture.

Industrialisation fundamentally changed the centuries-old situation of agriculture that developed for the past centuries by using generally renewable natural resources. These resources were significantly supported by a stream of industrial means, quasi-industrial labour organisation and agricultural calculation methods. This was accompanied by further biological progress and significant cultural changes. Consequently, the model of industrial agriculture began to develop, gradually replacing various forms of traditional agriculture. Table I.1 briefly characterises these models.

In developed countries, one can assume that intensive agriculture will continue to be practiced due to external inputs, i.e. actually industrial agriculture, although subjected to ecological rigours. Such agriculture meets expectations in terms of price competitiveness of food products and basic environmental standards. This is facilitated by changes in the agricultural policy of highly developed countries. An example of this is providing mechanisms of the Common Agricultural Policy with the cross-compliance principle, animal welfare requirements and environmental programmes. This trend also covers factory

(laboratory) agriculture that involves a shift from field production and animal husbandry to the production of agri-food products in factories – laboratories which, however, seems unlikely in the foreseeable future.

Table I.1. Basic attributes of traditional agriculture and industrial agriculture

Traditional agriculture	Industrial agriculture
Few or no external means of production High degree of self-sufficiency	Many external means of production (purchased) Low degree of self-sufficiency
Closed agrosystem cycles Little importance of consulting and marketing	Open agrosystem cycles Great importance of consulting and marketing
Preservation of agricultural biodiversity Evolution of genetic material by co-evolution	Loss of agricultural biodiversity Loss of co-evolution
Low waste emissions to the environment – no adverse externalities	High waste emissions to the environment resulting in adverse externalities
Little reduction in on-farm natural resources	Significant reduction in on-farm material resources due to waste emissions
Mixed agricultural production systems	Dominance of monocultures and specialised forms of agricultural production
Dominance of self-supply production	Dominance of market-oriented production

Source: Tisdell 2007, p. 368.

Besides lower unit costs, advantages of industrial agriculture are believed to be the release of agricultural land in favour of forests, ecological land, recreational areas and other civilisation development needs. Such agriculture along with genetic engineering and biotechnology (GMO) achievements provides opportunities for further agricultural production growth, ties in with the globalisation of the agri-food sector, but neither eliminates adverse social effects nor solves all environmental problems.

Sustainable agriculture, which has several forms (shapes), is an alternative to the industrial model. First of all, a terminological issue arises as to interpreting the term "sustainability" and "sustainable development". In static terms, the term "sustainability of agriculture" (or "sustainable agriculture") refers to forms (shapes) of agriculture that meet set (minimum, maximum) thresholds or/and keep (environmental, economic and social) sustainability orders in balance. Relations between the two orders can be competitive, complementary and synergistic. In dynamic terms, however, the correct term is "sustainable development" that should be construed as changes towards

sustainability – increasing the value of the summary (synthetic) indicator to measure sustainability.

The model of sustainable agriculture is based on four key attributes, namely: multifunctionality, sustainability, consideration of externalities and policy use (institutional factor)[2]. One of its shapes is socially sustainable agriculture that provides for dominance of family holdings, as a form of agricultural organisation [Woś and Zegar 2002].

Compared to industrial agriculture, essential features of sustainable agriculture differ [Krasowicz 2005]. The same applies to effects these models cause. Without going into too much detail in order to safe space, they are presented in Table I.2, which can be considered as a kind of summary of differences between both models of agriculture.

The model of sustainable agriculture will be found interesting and socially legitimate if it turns out that it enables agricultural production growth without increasing pressure on the natural environment. However, there are more premises that make such model of agriculture legitimate (cf. Section 2).

Table I.2. Features and effects of industrial agriculture and sustainable agriculture

INDUSTRIAL AGRICULTURE		SUSTAINABLE AGRICULTURE	
Features	Effects	Features	Effects
Concentration Specialisation Intensification Chemicalisation	Production abundance and high labour productivity Low health quality of food Environmental degradation Violation of viability of rural areas	Multifunctionality Sustainability Family nature of holdings Ecological agriculture	Support for viability of rural areas Environmentally friendly High quality of food Participation in culture

Source: Zegar 2012a, p. 58.

In the near future, an in-between option seems most likely, i.e. a multigenic system under which, with increasingly higher sustainability at the macroscale, industrial, integrated and organic holdings as well as holdings of other in-between forms, including mostly integrated and organic holdings, will

[2] Features of sustainable agriculture may be classified in more detail, namely: 1) assurance of intergenerational justice, 2) preservation of the agroecosystem, 3) protection of biodiversity, 4) assurance of economic viability of agriculture and rural areas, 5) production of safe food, 6) contribution to global sustainable development [Tisdell 2007].

operate. Integrated agriculture[3] is promising as a practical solution, as it does not include numerous weaknesses of industrial agriculture, takes account of environmental requirements and, at the same time, uses benefits of industrial agriculture. The level of inputs of industrial origin applied depends on plant and animal requirements. This requirement is particularly evident in the so-called precision agriculture. The system of integrated agriculture is similar to the one of agroecological production that is based on the use of achievements, particularly in biology, ecology, microbiology, but also on organic inputs, smaller-scale and more multilateral production as well as local food systems [Altieri 1995; Gliessman 1998]. Considering ecological and economic requirements, experts formulate the thesis that the future will belong to integrated agriculture [Majewski 2002; Runowski 2004]. In contrast, organic agriculture is a certain farming system whose basic features are: 1) sustainable plant and animal production; 2) minimal use of synthetic fertilisers, pesticides, growth regulators, fodder additives and using technologically unprocessed natural (biological and mineral) resources; 3) crop rotation, use of plant residue, animal manures, catch crops, off-farm organic waste, biological and mechanical pest and weed control as well as plant and animal protection. Thus, this form of agriculture is environmentally friendly, because no chemical fertilisers, plant protection chemicals and genetically modified seeds (GMOs) are allowed for use in this model of agriculture, while animals are kept as they would be in their natural habitats. In turn, there is no adverse impact on water and soil, as fodder additives and synthetic medicines are not allowed for use. The model of organic agriculture is based on the use of biology for "health" of soil, plants, animals, farmers, the environment and consumers [Ronald and Adamchak 2008].

The paradigm of sustainable agriculture goes beyond an environmental aspect and refers to social and economic aspects as well. The requirement to consider the full extent of externalities when assessing cost-benefit ratios for such a model, so that the convergence of the microeconomic optimum and the social optimum is achieved, assuming that the latter includes an environmental aspect as well, is of fundamental importance. In this case, the economies of scale, which can be maximised within a family holding, are different. In pursuit of sustainable development, family holdings gain a new opportunity for development of which they were deprived by industrialisation.

[3] The Integrated Agricultural Production System (integrated agriculture) is defined as *a method of farming that allows for pursuing economic and ecological objectives byconsciously using self-regulatory mechanisms of agrosystems, applying modern manufacturing techniques, systematically improving management and implementing various forms of progress, mostly biological progress, in a manner conducive to pursuing the system's objectives* [Majewski 2002, p. 48].

The paradigm of sustainable agriculture moves away from mechanical relations: parts – whole, which make the fallacy of composition likely to occur, towards biological relations typical of living organisms, where the whole is much more than an arithmetic (mechanical) sum of the parts. Thus, the paradigm of sustainable agriculture does not avoid a normative approach, emerging from the whole system – it does not follow passively its fate determined by market forces, but rather it provides for inclusion of policy instruments, i.e. an active role of the State. It is the political factor that has to determine boundary conditions for the functioning of market mechanisms.

The sustainable development of agriculture enables the use of undeniable large reserves that can be achieved by reducing loss and wastage of agri-food products, more efficient allocation of production inputs and distribution of manufactured agri-food products. As regards such development, much attention is paid to the rational policy of healthy nutrition which increases human creative capacity, not to mention reduction of health care expenditures and, above all, improves the quality of life. In fact, pursuing the sustainability of agriculture improves social welfare, including material welfare, culture, all the human capital and the quality of the natural environment.

2. Premises of sustainable agriculture

There are numerous reasons that make orientation towards the sustainable development of agriculture legitimate. Those, which we find most important, are presented below.

First reason: ***deficiency of the model of industrial agriculture***

Undeniable production and economic successes of industrial agriculture were paid for with significant environmental costs, including fertile soil loss, water and air pollution, biodiversity loss, dependence on non-renewable resources. Of course, not everything should be attributed to industrial agriculture, as land conversion for agricultural purposes is related to agriculture in general, regardless of a specific agricultural system.

The use of agricultural chemicals, which pose threats to both human health and the natural environment, is particularly criticised. Moreover, the time of cheap fossil fuel energy is a thing of the past. This situation's impact on agriculture is twofold. Firstly, it directly increases production costs due to increased prices of fuels, fertilisers, pesticides, etc. Secondly, it boosts demand for agricultural products for fuel production purposes, contributing to higher prices of these products.

Significant environmental risks are due to livestock production concentrated on large farms. They particularly include emissions of harmful gases, such as ammonia, methane, hydrogen sulfide, nitrogen oxides, and emissions of odour, noise, dust. There are also problems with faeces, fallen stock and residual antibiotics as well as other veterinary medicines. These problems are even greater in the case of large farms, however, preventing them requires significant inputs.

While a shift of labour resources to primarily emerging industry proved to be a strategy in the industrial phase of capitalism development, there is no such need at present, because the development of non-agricultural sectors is increasingly based on knowledge, information and capital rather than on labour force that is generally poorly prepared to meet requirements of the knowledge--based economy. Quite the opposite, if we want to limit unemployment and slum growth, including all related consequences, in developing countries, the outflow of labour force from agriculture must be prevented.

There is an inherent contradiction between basic principles of economics (efficiency), politics (equality) and culture (self-realisation). Industrial agriculture gave rise to a chronic crisis of agriculture, involving a compulsion to reduce the number of farmers, the trend of a relative drop in prices of agricultural products and subordination of farmers to corporate interests.

The industrial model of agriculture placed a farmer in the so-called technological treadmill that operates in accordance with the following sequence of events: increase in production (supply) over demand $\Rightarrow$ reduction in agricultural prices $\Rightarrow$ change in technology to increase production (intensification, concentration, specialisation) $\Rightarrow$ increase in supply (overproduction) $\Rightarrow$ reduction in prices $\Rightarrow$ increase in production $\Rightarrow$ etc. However, the "treadmill" does not ensure income parity, but it leads to unsustainable agriculture, especially because of incentives for using agricultural chemicals and monoculture. As a matter of fact, agricultural progress and growth effects are absorbed through the market mechanism by stronger partners from closer and farther agricultural environment and, ultimately, by consumers as well. The market is driven, in fact, by the current scarcity of goods – it does not take into account time and resource sustainability factors – and therefore sends false signals as to the social scarcity of goods and the efficiency of production processes. Such market signals deform the model of consumption, because prices of goods consumed do not take account of externalities, including environmental degradation costs. Nevertheless, there is no automatic solution in a market economy to offset income effects of depreciation of agriculture by the market. Therefore, there is the need for state intervention that involves transfers in favour of agriculture to

offset loss of income that was transferred from agriculture through the price mechanism [Woś 2000; Czyżewski (ed.) 2007]. The sustainable development of agriculture cannot be achieved without such a retransfer of income from consumers and taxpayers to farmers. However, retransfer opportunities diminish as globalisation develops.

A compulsion to maximise the economic benefit – following the "grow or die" maxim – increases the scale over the potential of agroecosystems as well. Microeconomic calculus of industrial agriculture ignores this compulsion. This is a different situation with respect to family holdings. As for the latter, the decision-making process is subject to a multi-dimensional purpose (multicriteria objective function) which includes, in addition to a *stricte* economic component, social and cultural components, such as: family welfare, children's education, cultivating the tradition of farming and folk culture, following a certain lifestyle, preferences and aesthetic sensations, safeguarding natural resources, etc. In the family farming system, an agricultural holding is integrated with a household (family). In a farming economy system, this relation is much weaker, but still significant.

It turns out that industrial agriculture does not pursue the economic benefit, i.e. *spiritus movens* of the industrial model of agricultural development. That is where a basic internal contradiction of such agriculture lies. It also turned out that foundations, on which the mechanism for achieving this benefit through production growth (by intensification, concentration, specialisation) and cost reduction (by increasing the scale of production and the substitution of production factors) was based, began to crumble. However, production growth increasingly faced a barrier of demand, while opportunities for the economic substitution of production factors began to wane. Above all, however, industrial agriculture reached a turning point in increasing marginal revenue per unit of input and even putting genetic engineering (biotechnology) achievements in place would not bring a significant change. Thus, industrial agriculture proves to be ineffective *because, on the one hand, it requires too many inputs of industrial origin (from non-renewable mineral resources) and, on the other hand, generates too many undesirable externalities* [Zegar 2012b, p. 131].

Second reason: ***demand for new goods and services provided by agriculture***

Demand for goods and services provided by agriculture other than those that reach the market has been brought to public debate and political action in the past decades. The time when consumers and urban residents expected agriculture and rural areas to supply food only has already passed. At present, demand covers new goods and commercial utilities. Agriculture is also a source

of products and services for both other inhabitants of the Earth and the biosphere itself. These goods and services (products) have always been provided, just like food products, but they currently have taken on a new importance due to two circumstances, namely a threat to their delivery by industrial agriculture and their growing social valuation. This is where a chance for agriculture lies. However, the problem is that the conventional market does not generate demand for these products, because market players interested in them are "silent"[4]. On their behalf, demand for these products may be reported by a political institution (the State) only.

Delivery of different products and services, both commercial and non--commercial, by agriculture is inherent in the concept of multifunctionality of agriculture. Out of numerous functions of agriculture, five of them can be considered as most fundamental, namely: food, non-food production (raw materials), economic, social and ecological. The importance of each function is not set in stone, as it depends on the condition of the environment (its capacity), social valuation and cultural conditions. The situation is different in countries that face famine and malnutrition and in developing countries, in regions where the natural environment is degraded significantly and in regions with untapped environmental potential. The problem is that agriculture – its particular form – can both enrich and impoverish the supply of these products, depending on specific circumstances and a place of that form in the whole complex hierarchical structure, including the level of an agricultural holding as well as local, regional, national, continental and global levels (cf. Table 3).

The manufacturing of products for food use – directly or indirectly – is a fundamental and, from a human perspective, undoubtedly most important function of agriculture. For centuries, this function has prevailed and determined a strategy for the development of agriculture in every latitude. The strategy aims at producing the greatest possible mass of agricultural products to feed the population. It changes because of food security importance of economic availability, huge food loss and wastage as well as food quality. In this context, taking also account of food's impact on health (diet-related diseases) as well as contrast between the food pyramid and the environmental pyramid, a balanced diet is recommended. The most environmentally friendly is a vegetarian diet with the lowest carbon, water and ecological traces. It is the cheapest one as well [Kwasek and Obiedzińska 2014, pp. 82, 89].

[4] For the term "silent market players", cf. [Zegar 2004].

Table I.3. Positive functions of agriculture

	Environmental	Social	Food	Economic	Cultural
Global	Ecosystem restoration Climate change mitigation Biodiversity	Social stabilisation Poverty eradication	Food security for all	Growth, international trade	Cultural diversity
Regional/ national	Ecosystem restoration Soil protection Water retention Biodiversity Pollution reduction	Sustainable migrations Social stabilisation Unemployment prevention Poverty eradication	Access to food National security Food security	Economic stabilisation Employment International exchange Tourism	Landscape Cultural heritage Cultural identity Social capital
Local	Ecosystem restoration Soil protection Water retention Biodiversity Pollution reduction	Social stabilisation Means of subsistence Balanced gender relations	Food, local and household security	Employment effects in the second and third sector	Landscape Local knowledge Traditional technologies Cultural identity

Source: IAASTD 2009, p. 21.

The function of production of renewable raw materials for e.g. chemical, pharmaceutical, textile, fuel and energy, automotive industries and for other sectors of the economy [Gradziuk and Wojtaszek 2002] has also occurred from the beginning of agriculture, but today it gains importance once again. After a fascination with synthetics, there is growing interest in products based on natural raw materials. This interest is also apparent from the fact that non--renewable raw materials (minerals) gradually deplete and agriculture can produce substitutes for all these materials in a renewable process. New uses of agricultural products can be of significant economic importance due to creating demand for these products, using farmers' labour resources, increasing farmers' income, rural economic and environmental benefits. However, there is another side of the coin, as increasing the non-food use of agricultural products, intensifies competition for land, water as well as competition between agro-energy production and needs of forest, water and other ecological systems. Globally, this issue is extremely important and can lead to dramatic choices.

A basis for the environmental (ecological) function is biomass generated by agriculture which, in fact, is Earth's real added value and agriculture's role in

restoring, storing and protecting natural resources as well as landscaping. Agriculture underpins the functioning of ecosystems, creates conditions for the preservation of biodiversity, plays role in the utilisation and neutralisation of anthropogenic emissions to the environment and suffers considerable loss and costs in this respect. Nevertheless, its role in environmental degradation, deforestation, erosion, desertification, climate changes, biodiversity destruction, etc. is known as well. The function of agriculture in managing the environment (land) – a good which can neither be exported nor imported and which is irreplaceable in rural development – gains special importance.

The economic function of agriculture is derived from the manufacturing of commercial products which requires human labour force whose remuneration allows for the existence of agricultural families. For thousands of years, agriculture has been a workplace and a source of livelihood (income) for most of the population and it remains the world's leader in this regard, excluding highly developed countries.

The social function is directly related to the role played by the agricultural community in civilisation and social development. Relations between society and agriculture – deeply rooted in history – are stronger than in any other sector. Apart from its obvious food function, it is all about agriculture's contribution to the viability of the social system, the development and cherishing of a system of values, the preservation of environmental public goods and the creation of conditions for active spending leisure time by urban residents, i.e. for recreation and relaxation (as regards those nature and landscape features that are closely related to agriculture and create conditions for sensations and aesthetic experience).

It is hard to overestimate the role of agriculture in the reproduction of labour force for the entire social economy and the maintenance of natural resources (land, space) for growing economy: technical infrastructure (roads, airports and communication routes), residential, municipal, service and industrial housing, mining facilities, afforestation, military facilities (military training grounds, military units), water reservoirs, sport and recreation etc. This agricultural land loss is inherent in economic development and civilisation progress. This can be expressed in economic terms – reducing agricultural capital.

Third reason: ***food security***

There are five issues essential for food security, namely: food production volume (supply of agri-food products), economical food availability, food quality, the level of food sovereignty and the environmental impact of the agri--food system.

The model of industrial agriculture enabled a leap in civilisation development by generating sufficient *quantum* of agricultural products to meet rapidly growing demand, but failed to tackle the scourge of famine. This was achieved, what must be emphasised, with a huge drop in labour force engaged in manufacturing and – in many countries – a reduction in land involved in agricultural production. The substitution of traditional production factors, mostly land and labour force, by industrial inputs proved to be highly productive and cost-effective. Industrial agriculture is appreciated for its abundant supply of cheap food, but this cheapness is illusory, as it is primarily due to disregarding external costs and – in the case of most highly developed countries – significant subsidies.

The generation of sufficient *quantum* of food products is an absolute but insufficient condition for food security, because also economical food availability, which is based on poverty, and food quality are necessary.

Food production growth through the use of numerous new industrial means of production and new technologies in agriculture as well as through growing "value added" in food industry affected the quality of food which, although improved in terms of organoleptic features, became less natural and often, paradoxically, harmful to health. However, more insightful consumers are increasingly aware of food's impact on health. The higher the economic level of societies, the greater the interest in food quality. Although most of private demand in the foreseeable period will be oriented to industrial agricultural products that are cheaper, the segment of the organic agricultural product market with high nutritional and health values – despite higher prices – expands rapidly. With increasing ecological and health awareness, growing income and the decreasing share of food expenditures in the structure of household expenditures, the role of price will give way to broadly understood quality.

The second half of the first decade of this century revealed that the concept of food security based on the market only failed to stand the test of time.

Fourth reason: *social cohesion*

Industrial agriculture is conducive to maximising benefits by relatively cheap food, shifting labour force from less to more productive uses, releasing agricultural land for other purposes and generating demand for means of production of industrial origin. However, less and less farmers enjoy these benefits. If there are no employment opportunities for those who lose their jobs in agriculture, their financial standing will not improve or they will be forced to benefit from state aid which, of course, will not improve macroeconomic benefits, but may even be detrimental to them. Beneficiaries seem to be

consumers, but these are consumers themselves who must ultimately contribute to this aid. The experience of highly developed countries reveals that, due to the secular trend of a relative decline in agricultural product prices, ensuring economic benefits to farmers generally requires significant transfers from taxpayers and consumers. Thus recognised macroeconomic benefits do not take account of the so-called social externalities.

Industrial agriculture makes the gap between the viability of agricultural holdings and the viability of rural areas (economic and social) increasingly wider as well as limits alternative business opportunities of the rural community due to its negative impact on the natural environment and the rural landscape. For obvious reasons, sustainable agriculture facilitates the viability of rural areas by creating conditions for their multifunctional development.

Industrial agriculture weakens social cohesion for several reasons. Firstly, rural localities begin to depopulate due to the release of labour force from agriculture, as jobs are created mostly in urban areas (formerly, this was due to the predominance of concentrated factory production; at present, it is much more due to capital efficiency). This clearly violates the viability of rural areas. Secondly, agricultural concentration and a compulsion to raise labour productivity limit leisure time, including all related consequences. Thirdly, one-side concentration on economic benefits distorted the system of values. Fourthly, industrialisation widened income and, in general, economic inequalities, undermining the principle of justice. Fifthly, industrial technologies coupled with the requirement of economic efficiency may impair food quality. Consequently, a consumer receives, in fact, a nicer packaged product, but of poorer quality and often even harmful to health. Sixthly, and finally, a farmer in industrial agriculture is included in a network and becomes its little gear, not to say a pawn subordinated to large corporations, losing not only freedom of decision-making, but also part of his/her own freedom, while expanding freedom is a basic objective of a liberal trend which, by the way, conflicts with limiting freedom by the State, but allows for enslavement by capital (corporations).

Although agriculture is losing its dominant position in absorbing labour inputs and as a source of income in more and more rural localities, it is essential for the preservation of the natural environment in rural areas. This environment is their main asset and its loss would be the end of rural areas as we know them. Agriculture plays a significant – simply hard to overestimate – role in developing the unique rural landscape which is a good *per se* as well as is important for non-agricultural activities and the quality of rural life, i.e. generally for the welfare of society.

Fifth reason: ***challenging the existing formula of progress***

Scientific and technological progress was fundamental for the production success of industrial agriculture. Using energy stored in mineral resources, accumulated over millions of years, into food production was of particular importance in this regard. Progress of this type considered wildlife as an enemy to be overcome rather than as a resource to be managed reasonably. Such concept of progress started to be challenged at the end of the last century, as increasing agricultural production through the use of depleting resources was found to be a dead end which necessitated coming back to a crossroads to take a different path – shifting from industrial intensification to agro-biological (agroecological) intensification that uses natural laws, microbiology progress and truly unlimited resources: solar energy and knowledge which is not only a renewable resource, but also the one that is reproduced positively.

In this regard, awareness of the need for reorienting research and education breaks through with much difficulty. So far, they have been one--sidedly oriented to industrial agriculture – usually driven by a short-term economic benefit. Knowing how the matter circulates in the environment allows for increasing the regeneration ability of agricultural land through an appropriate structure of fields, meadows, woodlots, water reservoirs, acting as barriers to non-point pollution, modifying microclimatic conditions and maintaining high biodiversity of the agricultural landscape. This is the only natural and economic system which can bring high crop yields, protect the natural environment together with ecosystems and landscape values. It turns out that the effects of intensification of agriculture through single-species agrocoenoses, the simplification of a vegetation structure, the extensive use of agricultural chemicals as well as excessive mechanisation and specialisation can be reversed without losing production effects [Kędziora 2007]. It is, therefore, advisable to increase the intensity of action to improve water retention, make soil cover more resistant to degradation, optimise a share of forests and woodlots and preserve and restore landscape biodiversity.

Experience in cultivation simplifications (e.g. conservation tillage, reduced tillage, direct sowing) that, in addition to environmental benefits, enable favourable economic effects (reduced energy and labour costs) with similar crop yields are promising as well. Such methods are already used on approximate 100 million hectares [Jankowiak and Małecka 2008].

We do not share a view that modern technology must be associated with the model of industrial farming, while traditional technology – environmentally friendly – must be referred to as old-fashioned. Evaluating technological "modernity" in economic terms only, following exclusively market valuation,

while ignoring other effects should be regarded as a mistake. Over the years, modernity has been associated with moving away from nature, breaking with the past, setting oneself free from material constraints. We know today that pursuing agricultural activities in accordance with environmental sustainability principles requires much more knowledge than when following the industrial model.

Non-commercial functions of agriculture give rise to significant revaluation of agricultural progress which can no longer be one-sidedly associated with concentration, specialisation and intensification understood conventionally. At present, progress is more about knowledge development rather than energy (labour force) growth. At the same time, we are today more aware of opportunities and risks related to subduing nature than in the past century.

Benefits were maximised by labour productivity growth which became a *credo* of the industrial period. Progress understood as such was associated with modernity. These interrelated processes formed a basis for land and labour productivity growth, however, ignored environmental concerns and rights of other users of the environment.

3. Conditions

Circumstances leading to a shift from the paradigm of industrial agriculture to sustainable agriculture that were referred to in the previous section as reasons are modified under the influence of conditions for implementing the latter [Zegar 2012b]. They can be divided into three groups/classes: environmental, economic and social conditions. This division is largely limp and it is hard to make it rigid, because each element of the sustainable development system has environmental, economic and social aspects. Moreover, conditions formed by globalization process were considered.

Environmental conditions. Constraints arising out of achieving and even exceeding the limits of using the natural environment, expressed metaphorically as the transition from an *empty world* to a *full world*, are considered as crucial. The global ecosystem (biosphere) is finite and contains limited resources in terms of both raw materials that may be used for economic development and opportunities for receiving and utilising emissions due to economic development and, in general, anthropocentric pressure. In this regard, apart from extreme views, there is a consensus about the collision of economic development and the environment. This is reflected in already established facts that certain biophysical thresholds have been exceeded. There are nine thresholds, of which three have already been exceeded [Rockström et al. 2009, pp. 472-475].

Depletion of non-renewable resources that provide raw materials for further processing into agricultural products will limit the volume of such

products, although continuous progress can ensure effective substitutes for these raw materials. However, there is no certainty in this regard, including environmental effects of possible substitutes. Also, the capacity of the natural environment to absorb (utilise) anthropogenic impacts has been exceeded, with climate changes and biodiversity loss being a prominent example. Consequently, it is clear that the ecosystem of the globe becomes a barrier to growth in terms of industrial technologies. The model of industrial agriculture contributes significantly to the emergence of the so-called environmental barrier. This implies that further agricultural production growth will have to be achieved by using growing knowledge, innovation and biomass based on the use of solar energy [Zegar 2014, p. 8]. Although these conditions concern in general the development of agriculture, regardless of the specific model – be it industrial, sustainable or mixed – their importance for the referred models is not the same.

The scarcity of environmental resources that are directly involved in agricultural production (land, water, energy minerals) and that affect the efficiency of transformation of inputs into agricultural products, climate and ecosystem changes (biodiversity) must be regarded as crucial for agriculture. Land construed as soil is usually, and rightly, taken as a basic factor of agricultural production. Currently, agricultural crops cover 1.5 billion ha worldwide which, including 3.4 billion ha of grassland, accounts for approximate 35% of Earth's land area. Opportunities for further agricultural land growth without damaging ecosystems, particularly forest ecosystems, are waning, while agriculture loses land in favour of urbanisation and technical infrastructure. This agricultural land loss is also due to wind and water erosion which affects as many as 1.2 billion ha of land and salinity – 10-15% of irrigated land[5]. Long-term fertility of 1/3 of agricultural land is under increasing threat, while approx. 1/2 of pasture area is turned into semi-desert and desert areas due to excessive use (grazing). The greater the population, the smaller the acreage of agricultural land per capita. Therefore, it is understandable that agricultural land, including its fertility, needs to be protected. This can be considered as a categorical imperative. Agricultural land, regardless of its form of ownership, must be treated as a public and common good that gains new strategic value as a resource [De Castro et al. 2013, p. 2].

Having no substitute, fresh water is a good of similar or perhaps even greater importance. Agriculture currently holds a share of 66-70% in the total consumption of fresh water derived from ground and underground as well as surface (flowing) resources. The groundwater table decreases as water is drawn

[5] Considering all soil degradation forms, this area increases to approximate 2 billion ha – most of it in Africa, Asia and Latin America [Cassman 1999, p. 5955].

to irrigate crops in countries whose population accounts for over half the world's population. China, India, Asia Minor, North Africa and North America suffer from acute water scarcity. Water scarcity may limit irrigated land growth[6]. Demand for water will be intensified by the transition to a meat diet in populous developing countries, as it takes nine times more water to produce 1 tonne of meat than 1 tonne of cereal[7].

The increasing water scarcity puts many countries in an even greater dilemma, i.e. whether to use water for industry and population purposes and provide less water for agriculture [IAASTD 2009; The Royal Society 2009]. Needs of other water users: plants and animals that make up biodiversity, and inherent demand of ecosystems for water to ensure that life-giving biogeochemical processes follow their normal course cannot be kept on the sidelines. A separate key issue is water degradation by agriculture due to pesticide residues, excess nitrogen, salt, heavy metals, soil sediments, pathogens, etc. However, opportunities for obtaining fresh water by using economically viable desalination techniques are growing rapidly.

Energy minerals are systematically depleted which makes them even more scarce. This situation is expected to lead to an inevitable increase in oil and gas prices, regardless of alternative – renewable energy sources. As for agriculture, it should be added that resources of one of basic fertilisers, namely phosphorus, are to be depleted within 50-100 years [Cordell et al. 2009].

Climate changes have drawn more and more interest from the 1980s. The reasons for this include the following: quickly progressing concentration of greenhouse gases in the atmosphere and its emerging effects, such as acid rain, smog as well as sand and dust storms. All these phenomena pose a threat to human health, reduce biomass growth, cause corrosion etc., but are generally local. In contrast, temperature growth[8] due to the growing concentration of greenhouse gases in the atmosphere that absorb and re-emit infrared rays is of global importance. There are approximate 30 greenhouse gases and the most important include: carbon dioxide, sulphur dioxide, methane, nitrous oxide and freons. The emission of these and other gases and dust (particularly soot) that

[6] Irrigated land covers approximate 270 million ha; this area accounts for approximate 40% of agricultural production, while non-irrigated land (1.1 billion ha) – for approximate 45% [Schultz 2010, p. 23].

[7] Water animal footprint – covers the entire lifetime and is based on water used for fodder production, water consumed by animals and water used for cleaning premises. Global average water footprint: beef – 15,500 l/kg, cheese – 5,000 l/kg, pork – 4,800 l/kg, poultry – 3,900 l/kg, eggs – 3,300 l/kg, milk – 1,000 l/kg, rice – 3,400 l/kg, wheat – 1,300 l/kg, maize – 900 l/kg, apples, pears – 700 l/kg, potatoes – 250 l/kg, lettuce – 130 l/kg [Hoekstra 2010, p. 25].

[8] The average air temperature in the last century has increased by 0.6°C and may rise by the end of this century by 1.4-3.5°C.

are generated mostly by burning fossil fuels exceeds the absorption capacity of the global ecosystem. Nearly 1/3 of anthropogenic emissions causing climate changes, including approximate 50% and 70% of methane (CH_4) and N_2O emissions, respectively – mainly from ruminant fermentation, faeces, rice cultivation and nitrogen fertilisers, are attributable to agriculture, while deforestation accounts for 18% of the impact on the climate [IAASTD 2009, p. 21]. Methane is largely a by-product of agriculture (ruminant breeding, rice cultivation), while nitrogen oxides are generated as a result of burning wood and fossil fuels, using nitrogen fertilisers. Industrial agriculture plays a shameful role in this regard.

Climate changes will have a serious impact on natural ecosystems which, in fact, can adapt to climate changes, but in geological time rather than to so violent ones as currently. These changes are expected to have an adverse impact on, among others: plant growth and crop yields, changes in the frequency of atmospheric phenomena with disastrous consequences (heat waves, droughts, floods) [Sulewski and Czekaj 2015, p. 76], a shift of the plant vegetation zone to the north by 300-800 km and upwards in mountains by 500 m, increasing threat of fungal diseases and weeds, an increase in the area of crops that require irrigation, increased salinity, a decline in crop yields in Africa, Central America, India and Southeast Asia; 400 million people more exposed to famine; more frequent forest fires, the disappearance of certain species of animals living in the coastal zone; the loss of many marine mammals living in the waters of the Arctic and Antarctica. The shift of the plant vegetation zone to the north and thawing of the Siberian tundra may cause a "methane bomb", as it will release huge amounts of methane accumulated there. Carbon dioxide and sulfur dioxide are also the main causes of acid rain referred to above that cause, among others, soil and water acidification.

Biodiversity is important not only for the integrity ("health") of the ecosystem, but also for human beings, as it is a potential source of unlimited material goods: food from natural (terrestrial and marine) ecosystems and from agroecosystems, raw materials for industrial purposes (rubber, oils, organic chemicals, wood, biomass, etc.), natural medicines. It creates a specific genetic library whose resources are used to increase crop yields (genetic engineering) and improve aesthetic appeal. Edible plant genetic resources, useful when it comes to feeding people, are of particular importance. The model of increasing agricultural production, which has been promoted so far, has been all about breeding and selecting the most prolific species, including those coming from other regions,

thus rapidly reducing the diversity of edible plants[9]. Agriculture, particularly industrial agriculture, adversely affects biodiversity as it involves simplifying the structure of crops – monoculture, using chemicals and diminishing natural plant and animal habitats. Agro-chemical corporations that promote GM seeds and take over knowledge collected for hundreds and even thousands of years, pose a particular threat [Sage 2012, p. 103].

Economic conditions. The most important economic condition is related to economic growth. It is primarily about a growth compulsion and related effects. The economic growth compulsion (imperative) is a fundamental feature of capitalism and neoliberal thought. This was neoliberalism which, promoting this particular model of the market economy, has led over the past few decades to "great degeneration" [Sadowski 2012, p. 13]. In particular, it has led to *unprecedented growth of financial markets aimed at getting richer not through work creating new values, but through speculative rotation of financial capital in pursuit of making profit on changes in stock market share prices ... Financial markets have become the main link of the economy chain that functions independently of the so-called real economy, i.e. production and trade ... This was the way of creating a new capital with clearly virtual features, as its value was based exclusively on expectations for the price of shares of these funds.* [Sadowski 2012, p. 14].

The growth compulsion is reflected in the "grow-or-die" phrase that necessitates staying competitive. In the market economy and the democratic system, governments have no other choice but to pursue growth-oriented policy, because the electorate's employment and income depends on that. The imperative of growth in relation to wealthy (developed) countries is increasingly challenged for its numerous effects. First of all, it is generally contrary to ecosystem constraints (biosphere) and is the main cause of the ecological crisis. Economic development during industrialisation was based on the unlimited supply of material inputs and the unlimited capacity of the environment to absorb waste (emissions). However, the sustainable socio-economic system requires, in addition to efficient allocation of resources and equitable distribution of wealth, the sustainable scale of production [Smith and Max-Neef 2011, p. 12].

[9] It is estimated that plant genetic resources useful for agriculture and food account for approximate 30,000 (compared to 300,000-500,000 of the recorded so-called superior plants in total). Out of these species, approx. 7,000 at different times and now just over 30 species were cultivated or collected for food purposes, including rice – 26%, wheat – 23%, sugar – 9%, maize – 7%, millet and sorghum – 4%, soybean oil – 3%, sweet potatoes – 2%, other vegetable oils – 6%, others – 20%. For more information cf. [Zegar 2012a, pp. 269-271].

The imperative of growth is also criticised in terms of welfare, in particular the non-linear relationship between economic growth and welfare. Manfred Max-Neef's threshold hypothesis provides some information in this regard. It says that for every society there seems to be a period in which economic growth measured conventionally (GDP) ceases to improve the quality of life; having this threshold exceeded, the quality of life may even deteriorate [Max-Neef 1995, p. 117].

The imperative of growth can also be criticised in terms of social and ecological rationality, primarily as the market takes no account of externalities. The tendency to disregard externalities and focus on what is measurable can be considered even to be natural, which does not diminish their importance, as the global ecosystem moves away from being "empty" towards being "full". If the market is expected to remain the main economic development management mechanism, market-determined prices must be made to recognise full (social) production costs [Brown 2011, p. 183].

Growth in income and, consequently, demand in general, particularly for food, which currently is the case in many developing countries, is an economic effect of the imperative of economic growth. The problem is that additional food must be produced without intensifying pressure on the natural environment. This huge challenge is made even bigger by the fact that a share of animal products in a diet of developing countries' population increased. Livestock production growth is achieved more effectively and efficiently (in terms of microeconomic efficiency) in the model of industrial agriculture, however, increased pressure is exerted on the environment. This is the most serious conflict between economics and the environment.

The liberalisation of the **market of products and services**, a product of neoliberalism, promoted by the WTO, leads to increased competition on agri-food markets which is driven by corporations. Agricultural operators, which are engaged in large-scale production, which use industrial technologies and, at the same time, do not take account of externalities, gain a competitive advantage. This, under the domination of market (economic) competitiveness as a sole criterion, facilitates industrial agriculture. As a matter of fact, intensified competition necessitates land and production concentration as well as specialisation which indeed brings the economies of scale, but also leads to excessive pressure on ecosystems and impairs non-commercial functions of agriculture.

Agriculture is somewhat specific when it comes to competition. What distinguishes it is the relationship between agricultural products and natural and climatic conditions which cannot be duplicated or imitated by competitors. At the same time, it is a circumstance favourable to trade, because trade makes

sense only in a diverse world in terms of manufactured products, culture, consumption etc. Then, there are niches for trade and competition, although flows of agricultural goods encounter greater resistance than in the case of industrial products and services. Natural conditions are evaluated in this case based on land capacity for high productivity with comparable capital and labour inputs. Labour productivity depends primarily on the ratio of agricultural land acreage to labour resources employed, i.e. – using economic jargon – the land--labour ratio. In fact, this is nothing new. In addition to technical-labour and capital-labour ratios, the ratio of land to labour (land-labour ratio) changed the direction of intensification, mechanisation and land concentration in densely populated countries (low land-labour ratio) and sparsely-populated countries (high land-labour ratio). At present, the land-labour ratio is increasingly important due to adverse externalities of intensive agricultural production methods. Countries with large *per-capita* land resources or with larger-area holdings are, *ceteris paribus*, more competitive in relation to countries with smaller *per-capita* agricultural land resources. In fact, deteriorating relations between agricultural intensification factor prices and ecological constraints make less intensive farming more advantageous. However, the labour cost is important, because allowing for a lower cost would improve competitiveness in relation to agriculture, where this cost is higher, if it is not offset by higher labour productivity.

The agricultural valorisation of the natural factor is crucial for the economic efficiency of using capital by corporations that, following the economic criterion only, seek to equalise the marginal efficiency of its use. The mobility of capital eases constraints resulting from the immobility of land, because – as Sobiecki accurately concluded – *attractive land may attract capital* [Sobiecki 2007, p. 107]. However, the immobility of land and labour force makes agricultural products encounter greater resistance than industrial products. This is made even more evident by globalisation.

Economic orthodoxy and neoliberal ideology of the last three decades have made **transnational corporations**, which follow microeconomic rationality and pursue own economic benefit, take the lead. The problem is that, in a competitive market (competitive economy) which increasingly resembles total competition, they can achieve it without taking account of externalities, thus making costs incurred in this respect passed on to others (taxpayers, operators) or future generations (if consequences of externalities are not suffered on a regular basis). Thus, corporations driven by the motive of economic advantage, usually short- and, at most, medium-term advantage – fuel the race to cross the biosphere's boundaries. Thereby, they make the time remaining to

develop an alternative to the use of the natural environment shorter. Corporations are more and more oriented on agricultural industrialisation, pushing family agriculture out of the market, forcing farmers to use technologies that pose a threat to the natural environment, health and the quality of life, as well as deepening social inequalities. Due to the pressure of social movements and the desire to multiply profit in every possible way, corporations engage in greening activities (such as precision, integrated and organic agriculture) and use nanotechnology and biotechnology innovations. They apply the latest innovations by making use of genetic engineering (GMO) achievements, precision and integrated agriculture practices. What is more, large-scale production is increasingly common in organic agriculture for whose products demand grows. This is how conventional agriculture reduces the pressure on the environment – it becomes more environmentally friendly. In many developing countries, however, pushing people out of agriculture under current economic and social conditions – different from those that were observed during the industrialisation of developed countries – contributes to urban slum growth and poses a threat of migrant tsunami.

The **capital market** becomes particularly important in the era of globalisation. The mobility of capital is one of fundamental features of globalisation. Capital circulates in search of the most effective application, taking the return on equity rather than value in use as a criterion to follow. The material economy gives way to a symbolic economy that grows (*vide* the sphere of financial intermediation) actually out of all proportion. Financial capital became a driving force in the functioning of the entire economic system. The objective to maximise the return on equity eliminated the objective to create value in use. Agribusiness corporations and capitalist agricultural companies take the return on equity as their priority, making the manufacturing of material goods dependent on it. Material production operators increasingly commonly rely on financial capital obtained on the financial market, thus making themselves dependent on that market. Consequently, a new risk arises as to the supply of food, because capital inflows and outflows at a given time are not related to demand for food, but rather to the return on equity used. This can destabilise the food market – food security – especially that there is no system of food reserves or system to stabilise the market.

To attract capital, countries may go for ecological and social dumping by giving up or lowering ecological standards, allowing for the low labour cost, reducing social demands, etc. It is also the case in agriculture when the global food system develops. To exploit the situation, countries with greater land resources use incentives to attract capital. Costs of that dumping are borne, of

course, by societies of countries that are forced to do so, however, benefits are enjoyed by capital providers – corporations. In fact, it is important to distinguish corporate competitiveness from state competitiveness. In the former case, competitiveness and microeconomic benefits depend on the amount of goods sold. In the latter case, however, competitiveness does not necessarily mean an increase in welfare (benefits), because improving microeconomic competitiveness through social or ecological dumping is beneficial for corporations, while the State's benefit is doubtful.

On the one hand, globalisation intensifies competition on the local market, as it is penetrated by global corporations (global market). At the same time, however, globalisation enables local producers to make use of global market demand, i.e. abolishes the barrier of demand for the so-called niche products (organic agriculture products manufactured by using traditional technologies; regional in nature). The market for these products, following its incorporation into commercial networks, becomes a global market, while demand – unlimited. Local products become global products. Demand for niche products is growing rapidly both on international and domestic markets as well as on the local market. In this last case, it can be used to promote agri-tourism and tourism in general. Moreover, besides traditional factors of competitive advantages (comparative advantages arising out of differences in production costs or the abundance of natural resources), there is branded, regional and niche product competitiveness. The Internet, direct sales and local market sales create opportunities for these products, in particular when such products conform to tradition and eating habits.

On the one hand, following the criterion of capital efficiency maximisation increases the value of the natural factor which determines biomass production opportunities (upper limit) and a set of potential products. On the other hand, this can lead to the over-exploitation of this factor, because it is driven by a short-term benefit rather than the principle of sustainability (long-term benefit). After having exhausted production capacity in a given area, capital can relatively easily move to a different, more efficient area. The primacy of capital accumulation during globalisation is released from restrictions laid down by the nation-state. This unlimited capital accumulation necessitates unlimited Earth exploitation as well. The results could be devastating for the natural environment and local communities. The global market – anonymous – abolishes ethical qualms of relying solely on profit as a criterion.

If costs of externalities are not recognised in the price, the imperative of the return on equity encourages agricultural industrialisation. The reign of the god Mammon seems to have no limits, same as privatisation and liberalisation.

Social conditions. Globalisation and mass media advances make it easier for cultures, ideologies and values to interpenetrate. Neoliberal thought promoted the thesis that following the "Western" path of development is purposeful and even inevitable also when it comes to agriculture. The idea that the world's economic development moves towards convergence based on the Western (U.S.) model is increasingly challenged, particularly given that the current model of U.S. agriculture – the object of desire and the ideal of liberal orthodoxy – is neither sustainable nor tenable in the future[10]. We know today that megatrends are not absolute and it is impossible to everyone to follow the path of economic development of highly developed countries, given e.g. the environmental barrier. It is not desirable as well, because it does not ensure that development will be stable and that own resources will be best used. This is so because it: 1) causes permanent dependence on external operators – strengthens a dual socio-economic system, 2) impedes the reasonable use of own resources and perpetuates threats in the long term (e.g. underdevelopment of own innovations), 3) forces the adoption of various patterns that pose a serious threat to countries which are still getting themselves established – e.g. consumerism [Kleer and Kleiber 2015, pp. 70-71]. Thus, it is necessary to look for alternative own solutions (paths) and use own knowledge and possibilities to do so [Zegar 2012a]. The vision and the political will to act are necessary to make it a reality. Such an approach makes sense for many developing countries that struggle with numerous challenges and barriers to development. Following the "Western" path by developing countries is criticised based on a reasonable concern that following that path is impossible, as the economic growth of the West in the 19th and 20th centuries was not only gradual, but also long-lasting and occurred thanks to innovations, building stable market institutions as well as morality and religion appealing to entrepreneurs. Furthermore, the time has come to recognise the intrinsic value of the world's diversity, including the diversity of civilisations, systems of values, cultures, goods etc. If we share the view that diversity is not only an objective but also a desirable phenomenon, a new insight into agriculture must be adopted as well. It will probably develop according to different trajectories within the scope shaped by the model of industrial agriculture and the model of organic agriculture. The market mechanism itself drives development in one direction, however, having parameters set by politics included, this mechanism will drive development in the other direction as well, responding to values shared by a significant fraction of the world's community. These

[10] The article, entitled "Diet for a Small Planet by Frances Moore Lappé" [Boucher 1999, pp. 103-126].

values also include autotelic treatment of land, as it is a priceless gift and it is *luck and duty of every human being to cultivate and care for it* [Schumacher 1981, p. 126].

The values of Euro-Atlantic civilisation no longer shine that much, as for the last few centuries, the system of parliamentary democracy is not essential for capitalism, while monetary values involve more and more risks. The world's military security, particularly a rapid reaction force in hotspots, must be considered as well. At present, the United States of America only are capable of such action, but it becomes less and less sufficient in the wake of growing threats. Thus, the question arises whether new economic powers will assume the same role or take military effort, but not only to pursue own interests, i.e. economic or political expansion, or securing scarce raw material resources for own use. The latter, in particular, may become a hotbed of many conflicts.

The problem with agricultural sustainability is that the economic mechanism of the free market is not directly oriented on food security or food quality or environmental protection, but rather on capital accumulation by the maximisation of the economic benefit (profit). Competition, where the most competitive operators win and losers are eliminated, is a driving force. Modern agricultural holdings take the maximisation of the return on equity, less often – labour productivity, and even less often – land productivity, as a criterion to follow. In pursuit of the so-formulated economic objective, holdings willingly ignore externalities shifting the responsibility to others, thus causing discrepancy between the microeconomic (private) optimum and the macroeconomic (social) optimum.

The currently prevailing modern free-market economic system follows criteria that move away from sustainability. In this system, the economic benefit, competition and growth come first, while externalities, including public goods, are ignored. In its pure form, the system takes account of monetary categories only, putting cultural, ethical and humanitarian considerations aside.

Scientific and technological progress during the industrial era became a *panacea* for any barriers to industrial development – unlimited growth, all the more so given that risks seem remote (these are rather problems of future generations). As for agriculture, progress was one-sidedly oriented on industrial agriculture and ignored alternative types of agriculture, such as organic agriculture. Nevertheless, that progress created new risks related to natural and social environment destruction. Progress oriented on large industrial holdings pushes small family holdings to choose poorer soil or even eliminates them. The entire business environment (banks, trade, suppliers and food industry companies, consulting, etc.) are oriented on large holdings and export products. What is more, urban residents – encouraged not only by advertisements, but also

often by prices and easy access (supermarkets) – buy more and more imported food which is detrimental to local farmers' product prices. Agriculture is thus still at a crossroads: either we will try to resolve the problem of food by accelerating industrial technologies or by the use of agroecology[11].

Consumers became main market "players" (anyway, this is what they think), because they determine how to allocate their demand. Increased awareness of the impact of food and its quality on health makes the latter even more important: nutritional and health values. At the same time, cultural megatrends, which are promoted by corporations and advertisements, lead to a poor and unhealthy diet whose effects, i.e. obesity and related diseases, are observed not only in wealthy but also in poor countries[12].

Externalities. Globalisation takes the problem of adverse externalities and public goods to a higher level [Zegar 2007]. Adverse externalities are integrally associated with agricultural production. Ignoring them in microeconomic calculus lowers production costs, *ergo* increases competitive power. A failure to make enterprises pay actual social costs for environmental damage is a specific form of subsidy and therefore violates the principle of fair competition. Externalities can only be internalised into microeconomic calculus – agricultural holdings are forced to take account of them – by way of state intervention. The erosion of state power during globalisation may lead to the weakening of intervention required to internalise the effects of (adverse) externalities. This means that these externalities will be generated in excess. Globally, such excessive adverse externalities are hard to control due to no institutional (political) factor at all at the global level or its weakness – difficulties in making relevant arrangements and enforcing any of them [Stiglitz and Carlton 2007; Szymański 2007].

A similar situation concerns public goods whose production under *stricte* market conditions is deficient. These goods occur at local, national, regional and global levels. At the first two levels, encouraging agricultural holdings to manufacture public goods necessitates transfers from taxpayers, namely payment for manufacturing them. At the regional level, this is also possible if appropriate organisation is applied, as is the case in the European Union. Yet, at the global scale, no mechanism has been developed so far to reward agricultural

[11] The issue is perfectly addressed in the article, entitled "World Hunger: Twelve Myths" by Frances Moore Lappé, Joseph Collins and Peter Rosset, with Luisa Esparza [Boucher 1999, pp. 4-60].

[12] The relatively highest obesity rate is observed in Nauru (78.5%), Tonga (56.0%), French Polynesia (40.9%), Saudi Arabia (35.5%), the United Arab Emirates (33.7%) and only then in the U.S. (32.2%) [Pardue 2010, pp. 797-802].

holdings for providing global public goods[13]. At most, attempts are being made to stop the degradation of such goods. However, the time has come to admit that Earth's resources are a common good. This was expressly emphasised by Pope Benedict XVI in his Encyclical Caritas in Veritate: *What is also needed ... is a worldwide redistribution of energy resources, so that countries lacking those resources can have access to them. The fate of those resources cannot be left in the hands of whoever is first to claim the spoils, or whoever is able to prevail over the rest* [Benedict XVI, p. 39]. The international community increasingly demands action to be taken in the interest of those goods, particularly the global natural environment[14].

As of now, political power (government) at the planetary level seems unlikely. Coordinating actions of individual countries, having global corporations muzzled, so as to appropriately recognise relations between the parts and the global ecosystem in the economic mechanism, is more realistic. It proves to be extremely difficult, as it encounters resistance, because it is necessary to restrict the sovereignty of nation-states. If consensus on global issues is somehow reached successfully, it usually suffers from the common denominator syndrome. Incidentally, sovereignty for the benefit of global corporations can paradoxically be easily limited (even special incentives are developed to attract their capital), while it is extremely difficult to limit sovereignty for the benefit of planetary common goods.

Globalisation takes agricultural problems to the planetary level, giving them a new impetus and strongly influencing agriculture of individual countries. The functioning of agriculture is increasingly determined by external forces, mostly corporations that encounter no counterweight, because the role of nation--states weakens, while economic globalisation outpaces political globalisation. The optics of large corporations prevails, while political institutions of countries or regional integration organisations are increasingly less able to correct adverse

[13] Global public goods are goods that bring benefits to all countries, people and generations, such as climate stability, environmental sustainability, food security, disease control/management, biosecurity, international agricultural research, the stability of the financial system. The rationale for the foregoing was provided at the 27th International Conference of Agricultural Economists, entitled "The New Landscape of Global Agriculture" in Beijing in August 2009.

[14] The following institutions are proposed to manage global common goods: 1) A Global Reserve (collecting and analysing information on the economy's environmental impact), 2) A Global Federation (based on the EU model), 3) Trusteeships of Earth's Commons (would protect the ozone layer, the atmosphere, the oceans, and the rather global commons necessary through the work of the Global Reserve), 4) A Global Court (would resolve disputes arising out of the operation of these institutions and hold them to their charters [Brown et al. 2009, pp. 113-137].

effects of the global market. This applies primarily to externalities and the protection of global common and public goods.

Globalisation driven by powerful forces, primarily information technologies, transnational corporations, capital markets, consumerism, abolishing barriers to the free operation of the market mechanism, opposes the need for the sustainable use of immobile land.

The liberalisation of the flow of goods, capital and innovations abolishes demand constraints that were in place within the national market, which – in the closed economy within the State – were more and more evident together with growing production opportunities created by the development of industrial agriculture. Some agricultural holdings could develop only by driving other less competitive agricultural holdings out of the market (production). However, this elimination encountered resistance in political, social but also macroeconomic terms. Under globalisation conditions, competitive operators consider demand as no barrier, while state intervention is much less significant. The real economy is replaced by the symbolic economy in the form of flows and financial transactions. Under these conditions, there are basically no barriers to following the microeconomic decision-making criterion, while the global market – completely anonymous – abolishes ethical qualms of relying solely on this criterion[15].

Generally, globalisation, on the one hand, creates new opportunities for agriculture and rural areas, but, on the other hand, it increases the risk of environmental degradation and weakens the social functions of agriculture, namely poses a threat to the multifunctionality of agriculture and rural areas, by making agricultural holdings directly or indirectly subordinated to global corporations, intensifying production concentration, intensification and commercialisation. The politics should therefore find a balance between benefits (usually economic benefits) and disadvantages due to depopulation, the migration of the most educated and entrepreneurial people and the loss of environmental goods.

4. Rural areas

For centuries, rural areas were in the lead when it comes to development, while urban areas – emerging mostly from rural localities – grew slowly as rural areas, more specifically agriculture, increased economic surplus more than it was necessary for own existence. Industrialisation, which would not have been possible without the participation of rural areas, accelerated this process

[15] Liberalisation *de facto* relieves the State from the obligation to ensure food security, namely abolishes the compulsion to produce food typical of the closed economy.

significantly. These were rural areas and agriculture that contributed significantly to industrialisation. This contribution was mostly fourfold, i.e.:

1. provision of cheap labour force whose reproduction costs were incurred by rural areas;
2. provision of cheap food (underpricing of agricultural products, mandatory deliveries) which held back pressure on increasing non-agricultural remuneration, thus improving opportunities for accumulation *ergo* investment;
3. creation of demand for industrial goods (agricultural production goods, investment and consumption goods);
4. initial capital accumulation. In turn, industry, more generally all the phenomena referred to as industrialisation, exerted more and more influence on agriculture and rural areas.

As for agriculture, it is mostly all about the fact that it became driven by capital, making it subject to market economy rules and launching the so-called agricultural industrialisation (cf. Section 2). As regards rural areas, the following transformations took place [Zegar 2009]:

1. economic importance of agriculture followed a downward trend;
2. deagrarianisation of rural areas (decreasing share of the population whose income depended mostly on agriculture);
3. demographic changes (lower fertility rate, increased life expectancy);
4. improving educational level;
5. more and more aspects of rural life becoming commercialised (which makes rural residents engaged in capital accumulation);
6. incorporating the local (rural) economy into the global circulation of production and consumption (both as a result of trade liberalisation and new opportunities offered by the Internet);
7. consumption and lifestyle patterns becoming similar to those of urban residents (transfer of urban life, consumption and behavioural patterns);
8. change in the way rural residents live (this applies even more to urban residents), i.e. spending more and more time at work and commercial facilities, while less and less – at home.

Additionally, there are migrations that leave the rural population with less and less vitality.

Industrialisation resulted in the economic depreciation of rural areas through the transfer of value added from rural areas, mostly from agriculture, the allocation of public resources favourable for urban areas (construction of residential buildings, infrastructure, workplaces) which widened the gap between personal income (disposable) and the labour cost (remuneration).

Furthermore, industrialisation and urbanisation diminished human and social capital in rural areas by making the most entrepreneurial individuals leave them. What is more, natural capital, i.e. the main asset of rural areas, was depleted.

Such changes have long been taking place in more economically developed countries and now they are occurring in other countries in all regions of the world. They result from general civilisation development, in particular industrialisation and related cultural processes. Industrialisation helped absorb the surplus of labour force of rural families by non-agricultural sectors, mostly industry, develop technical infrastructure, primarily road and network communication (telephones, the Internet), as well as social, educational, cultural and financial infrastructures. These changes do not take place evenly – both in terms of their scope and pace – in different regions of the world, but their direction is similar.

A change in the function of rural areas and the intensification of their relationship with urban areas should be treated as objective phenomena. The former is mostly all about decreasing agricultural production functions in favour of non-agricultural production functions, particularly non-production functions (place of residence, recreation, social, natural and cultural services). This is due to social expectations (demand): *The time that cities merely expected the surrounding countryside to supply them with cheap food is over. Today, there are new needs and expectations* [Ploeg and Roep 2003, p. 39]. Demand for new rural and particularly agricultural goods and services increases the economic surplus of rural areas through direct payments for such goods and services.

New phenomena, which can reverse a long trend of rural deprivation, occur in relations between rural and urban areas. Let us mention just a few out of many more. Mostly in the last quarter of the 20th century, migration trends, including capital, have reversed in the U.S. and Europe. The village ceases to be *passé*. Those migrating to rural areas can be a major force in ensuring the vitality of rural areas – spending a significant part of their income at local facilities, can also create jobs for existing residents. Currently, not only retirees move to rural areas, but also more commonly freelancers and executives, i.e. innovation and added value creators. A shift to the knowledge-based economy makes innovations more important which, in fact, are created at science and research facilities located in large urban areas in general, but their transfer (promotion) is much easier due to the development of technical infrastructure and new means of communication (particularly the Internet).

At present, rural areas, just as agriculture[16], are faced with having to choose a path for further development, a different one for different rural areas.

[16] For detailed reasons, cf. [Zegar 2012a].

As a matter of fact, rural areas are highly – and increasingly – diverse not only environmentally, but also demographically and socio-economically. Some of them increasingly resemble towns – differences wane. Thus, the dichotomy between urban and rural areas is no longer reasonable and localities, rural by name, need to be placed on a continuous line between city centres and suburbs which include both highly rural localities and numerous urban areas. Indeed, this makes the concept of distinguishing rural areas according to EU, OECD or U.S. criteria reasonable. Rural areas do not and should not copy urban areas. They should retain their economic autonomy (agriculture along with agriculture-related activities, small-scale industry and craft, the service sphere primarily -related to environmental and landscape values, infrastructure, but also culture and lifestyle. *Rural areas as "mini towns" with their small potential are no alternative to urban life. They will be an alternative if they retain, while adapting to contemporary requirements, their features as a depositary of unique resources and values that make up the quality of life unavailable in urban areas* [Wilczyński 2003, p. 9].

There is no one right path for all rural localities. A strategic direction – a kind of a roadmap – for rural development should be sustainable development which depends on economic and social conditions as well as the natural environment of rural areas. As for this direction, relations for the globalisation option – joining the global economic cycle which also involves submission to rules of the global market and international corporations – and the option of building the local economy should be selected.

With regard to the economic condition, this is mostly all about creating added value and its flows (outflows or inflows) between rural and urban areas as well as distributing rural income (value added) between various objectives, and also about operating costs of the rural community. Industrialisation made rural areas open to economic flows from and to their surroundings, thus causing the transfer of more and more activities to non-agricultural operators. Industrial products replaced traditional rural craft and handicraft products. Agricultural development driving forces moved outside rural areas (means of production of industrial origin, innovations, deepening of agri-food processing), similarly to changes in consumption patterns in favour of non-agricultural products. This led not only to leaving rural areas with lower-productivity activities – newly-created value – but also spending of income generated elsewhere. When it comes to money circulation, more and more money went to non-agricultural operators. Money acquired by rural residents was less and less capable of generating demand for agricultural goods and services. Such money circulation, of course, undermines rural economics – local economics, to the detriment of local

communities. This was economically reasonable, because labour productivity in non-agricultural sectors – large-scale industrial production – and in large-area and/or large-scale production agriculture was significantly higher than in small--scale family agriculture and rural craft.

Raising rural vitality necessitates increasing bloodstream sizes – money circulation – by both increasing value generated in rural areas (in agriculture and outside agriculture) and keeping as much money in rural areas as possible. The value generated can be increased by the restitution of the local economy undermined by industrialisation, including the abandonment of the model of industrial agriculture which, by eliminating family holdings in favour of farms and large-scale enterprises, also contributed to rural degradation[17]. In place of the industrial model, different forms of agriculture should be developed, especially those based on agroecology that makes use of local natural, socio--economic and cultural environments. Such agriculture is oriented on the varied endogenous potential of local agrosystems rather than on homogenisation typical of industrial agriculture [Guzmán and Woodgate 1999, p. 304].

Infrastructure investments are particularly important for the local economy, as infrastructure creates new opportunities for development, including traditional rural activities, such as agriculture and craft, as well as new ones. They are also essential for mitigating major rural problems: economic underdevelopment, high unemployment, low labour force mobility, high dependence on agricultural income, the depopulation of certain rural areas and, in general, improving the quality of rural life. The development of means of broadly understood communication encourages contacts with other rural localities and mainly urban centres, thus reducing costs of moving goods and services and also commuting. Owing to replacement of horse-carriages by cars, goods could be transported much more easily. Transport by car is believed to be more convenient than by train, because the former can carry vegetables, fruit and other agricultural products directly to a market or other sales points [Hibbs 2005, p. 159]. It is also more convenient for people to get to their work in urban areas, but lack of functional roads can turn transport by car into a nightmare [Bański 2014, p. 24]. In turn, electronic communication facilitates information and financial capital flows, making them free from distance-related barriers and significantly reducing costs in this respect. Technological progress in communication offers a chance to overcome geographical and informational isolation. The Internet provides access to current information which operators find essential to stay competitive in the modern economy [Rainer et al. 2003, p. 711].

[17] Economic, natural, social and other consequences of industrial agriculture are addressed thoroughly, among others, in [Zegar 2012a; Goszczyński 2014, pp. 90-91, Table 10].

Human and social capital, including cultural capital, is especially important with regard to social condition, thus necessitating social infrastructure which is essential for the development of human capital and the quality of life. It is required for the sustainable development of rural areas and civilisation progress in general [Dolata 2014].

The protection of environmental resources in rural areas is important not only because the natural environment is an irreplaceable and most important attribute of rusticity, but also due to its growing importance (resources, values, landscape, space) in many functions and applications related to manufacturing, services (tourism, sport, recreation, health), housing, culture etc., creating opportunities for new economic activities that satisfy new demand. To preserve natural capital, various barriers need to be abolished and action needs to be taken by local governments for achieving an environmental, social and economic balance. In this context, nature must be treated as a public good, leaving its intrinsic value and importance for the functioning of geochemical processes, which determine Earth's living conditions, aside at this point. A conflict exists between objectives of the present generation and future generations, because current interests often encourage the over-exploitation of nature (above its recovery rate) at the expense of future generations. That is how it often happens (for example in Natura 2000 sites). The conflict of economic and environmental objectives calls for political solutions mainly due to the divergence of these objectives and difficulties in having goods and values of the natural environment properly indexed and valued. A similar dilemma concerns land which is a private good but, at the same time, a specific public good. Therefore, the use of that private good, i.e. land, should be subject to certain rigours to prevent benefits arising out of land as a public good from being diminished.

Globalisation made the world open to the flow of capital, goods and services as well as, but not that much, people, thus creating unprecedented opportunities for competitive operators and individuals and also abolishing the barrier of demand but, at the same time, bringing previously unknown threats. Globalisation is accompanied by two opposite – dialectically linked – trends. One involves the homogenisation of places, cultures, values and goods, while the other – increasing the value of local specificities that can become a commercial good and encourage the community to become part of the global division of labour and capital circulation [Marini and Mooney 2006, p. 92]. Alongside the penetration of local markets by corporations, there are new opportunities for local producers to place their products on the global market (niches). Generally, however, the rural community has less and less freedom of choice when it comes to rural development forms, because commercialisation

and financialisation cause increased reliance on external capital which goes to places that offer opportunities for achieving the highest profitability.

Globalisation also poses a threat, as rural localities compete with one another and with urban areas. Similarly, countries compete to attract capital, because it creates workplaces and enables development. Rural communities are less privileged because of e.g. fewer job opportunities (workers: qualifications), while attracting capital at the expense of natural capital is inadvisable if it leads to the deterioration of environmental aspects of the quality of life. Corporations begin to use natural resources, land, labour and other agricultural and rural resources, thus destroying the old-time system of mutual relations between rural areas and regions, as well as weaken the rural social system. Moreover, a new international division of labour (allocation) emerges in which large amounts of unskilled labour force and related production are transferred to newly industrialised countries. In the age of (corporate) globalisation and financialisation, most of what gets produced and consumed in the global economy is decided in corporate boardrooms in London, New York, Tokyo and other financial centres around the world [Lyson 2006, p. 292].

Challenging concentration, which was a dominant trend in industry, agriculture and services during industrialisation, is a favourable circumstance as well. However, the time of industrial behemoths – as opposed to agricultural holdings of latifundium size or large centres of commerce and recreation – has already passed. As industry deconcentrates, craft gets a new chance. At the time of industrialisation, rural areas were losing ground, because their activities, particularly agriculture and craft, lost in economic terms – created less value added per employee or unit of capital employed. Communities dominated by a large enterprise (corporation) are vulnerable to greater inequality, lower levels of welfare, increased rates of social disruption than localities where the economy is more diversified. Hence, policies to promote and strengthen regional trade associations, local industrial districts, cooperatives or producer groups and other forms of local entrepreneurship should be an economic development strategy [Lyson 2006, p. 301].

As for Poland and other Central and Eastern European countries, accession to the European Union and covering agriculture and rural areas with the mechanisms of the Common Agricultural Policy are an extremely favourable circumstance. This significantly boosted changes in rural areas, as it entailed:

- weakening the economic (income) barrier to structural transformations in agriculture (providing agriculture with significant transfers earmarked for its modernisation);

- boosting the development of technical infrastructure in rural areas (transfers of investment funds);
- protecting resources and values of the natural environment in rural areas (investment funds);
- eliminating some part of excessive agricultural and rural labour resources by their migration abroad (opening the labour market).

The sustainable development of rural areas can be most effectively pursued by the effective and efficient use of available rural resources (assets), i.e. resources and values of the natural environment – getting rent based on resources and values of the natural environment (land rent, natural rent), the development of local entrepreneurship – using local natural, cultural resources (e.g. cuisine, craft). Relying on external transfers (*vide* CAP), rendering services at the expense of the environment (e.g. storage of waste, location of noxious industrial plants) can be rather *ad hoc* and short-term. It is therefore all about a neo-endogenous approach to development: using local material and capital resources, so that as many benefits as possible remain in a region, following needs, opportunities of the local community, making the population participate in development (social economy idea), developing and using social capital (mutual trust – lower transaction costs and cooperation), and a territorial (holistic) approach rather than a sectoral approach. This approach is reflected in EU regional policy which assumes the *community-led creation and stimulation of development* [Nurzyńska 2014, p. 38].

For the sustainable development of rural areas, their spatial development – spatial order, is essential. This is considered as Achilles heel of Poland. Spatial policy (space is non-stretchable, i.e. limited): setting urbanisation boundaries; limiting investment activities to already urbanised areas; leaving areas open (ecological land, floodplains/polders etc.); space as a cultural value; landscape (rural architecture as a landscape element: houses, mansions, public buildings, parks, including mansion parks, roads, paths, mills, windmills, the chessboard layout of fields, etc.); preventing landscape uniformity – each locality should/could be unique [cf. Wójcik 2014]. Spatial planning should necessitate the concentration of building developments, the integrity of rural settlements, enrich and protect the landscape. The way space is developed translates into the efficiency of economic activities (just like the chessboard layout of land and agricultural holdings in agriculture) as well as infrastructure operation costs and maintenance costs (infrastructure costs, transport cost, costs of using public facilities etc.). Costs of faulty development can be exemplified even by the construction of roads and highways. Suburbs do not have to be a nightmare, and not all villages must exist.

Conclusions

Agriculture, as far as its development is concerned, has found itself at a crossroads whose two main trajectories are set by the model of industrial agriculture and the model of sustainable agriculture. The former is a product of agricultural industrialisation which has its origins in the 18th century. In synthetic terms, it covers five phenomena, namely: 1) intensification of agriculture by using industrial means of agricultural production, 2) concentration of production potential (of land and capital) and production, 3) specialisation of holdings and regions as a whole, 4) commercialisation and 5) financialisation. Industrialisation was accompanied by the implementation of technical, agronomic and genetic advances in agriculture, while technological changes enabled a simultaneous improvement in land and labour productivity which, in material terms, is reflected in the phrase of *cheap and abundant food* referred to industrial agriculture. Industrial agriculture is appreciated for its abundant production and high labour productivity, but it is criticised for the poor health quality of food, environmental degradation and the violation of rural viability.

Sustainable agriculture, which has several shapes, is an alternative to the industrial model. The model of sustainable agriculture is based on four key attributes, namely: multifunctionality, sustainability, consideration of externalities and policy use (institutional factor). The model of sustainable agriculture goes beyond an environmental aspect and refers to social and economic aspects as well. The requirement to consider the full extent of externalities when assessing cost-benefit ratios for such a model, so that the convergence of the microeconomic optimum and the social optimum is achieved, is of fundamental importance. In this case, the economies of scale, which can be maximised within a family holding, are different. In pursuit of sustainable development, family holdings gain a new opportunity for development of which they were deprived by industrialisation.

The need for orientation on the sustainable development of agriculture is underpinned by the following reasons: frailty of the model of industrial agriculture, demand for new goods and services provided by agriculture, food security, social cohesion and challenging the existing formula of progress.

Circumstances leading to a shift from the paradigm of industrial agriculture to sustainable agriculture that were formulated as reasons are modified under the influence of conditions for implementing sustainable development: environmental, economic and social. Out of environmental conditions, constraints arising out of achieving and even exceeding the limits of using the natural environment, expressed metaphorically as the transition from

an *empty world* to a *full world*, are considered as crucial. Resources of agricultural land, water, energy minerals, climate changes and biodiversity are of particular importance. Out of economic conditions, those related to trade liberalisation, the imperative of growth, transnational corporations and the capital market become significantly important. Then, cultural megatrends, the phenomenon of consumerism and externalities play an important role in the social sphere.

Rural areas and agriculture contributed significantly to industrialisation and urbanisation through the transfer of value added from rural areas, mostly from agriculture, the allocation of public resources favourable for urban areas and diminishing human and social capital as well as natural capital that is the main asset of rural areas. At present, rural areas, just as agriculture, are faced with having to choose a path for further development, a different one for different rural areas. A strategic direction for rural development should be sustainable development which depends on economic and social conditions as well as the natural environment of rural areas. Raising rural vitality necessitates increasing bloodstream sizes – money circulation – by both increasing value generated in rural areas (in agriculture and outside agriculture) and keeping as much money in rural areas as possible. The value generated can be increased by the restitution of the local economy undermined by industrialisation, including the abandonment of the model of industrial agriculture in favour of different forms of agriculture that make use of local natural, socio-economic and cultural environments. Infrastructure investments are particularly important for the local economy, as infrastructure creates new opportunities for development and is also essential for mitigating major rural problems: economic underdevelopment, high unemployment, low labour force mobility, high dependence on agricultural income, the depopulation of certain rural areas and, in general, improving the quality of rural life. The sustainable development of rural areas can be most effectively pursued by the effective and efficient use of available rural resources, i.e. resources and values of the natural environment, local entrepreneurship – using local natural, cultural resources. For the sustainable development of rural areas, their spatial development – spatial order, is essential.

The global agri-food system is at a crossroads when it comes to further development and faces great challenges and new conditions. This necessitates further research on the task that will relate in particular to:

1. following discourse at various international fora related to agriculture and agri-food development paths as well as effects formulated in place of the Millennium Development Goals – Sustainable Development Goals;

2. premises as well as national and microeconomic conditions for the sustainable development of agriculture and rural areas;
3. costs and benefits of the sustainable development of agriculture in Poland;
4. analysis of policy instruments for the sustainable development of agriculture, rural areas and the food economy;
5. scenarios for the development of agriculture and the food system after 2020.

Chapter II

PRODUCTIVITY AND PROFITABILITY IN THE CONTEXT OF SUSTAINABLE AGRICULTURE

Introduction

Technological advances after World War II allowed the dissemination of industrial agriculture in virtually all corners of the world. The result of mass production of food is its relatively high availability, which significantly contributed to the development of human population. However, the effect of these changes is a transformation of the scale of human impact on the environment.

Already in the 1960s it was noted that many environmental problems have become global. Today it can be said that humanity has exceeded the planet's restoration ability, which means that the level of annual resources consumption is greater than the capacity for their regeneration. As a result, we can refer to Earth as a full, or congested planet. What it means is, that the current level of technology has exhausted the possibility of further expansion. As a consequence, there is a need to seek new ways of civilizational development, which would take into account the limitations of the environment. It is particularly important in the agricultural sector, which is subject to increasing pressure in terms of ensuring the supply of large amounts of food, while increasing attention to the environment. The lack of an appropriate policy in this area, however, may result in severe consequences leading to a decrease in land productivity. As a result, it is required to implement new solutions based on the intensification of agricultural production while caring for the environment. These criteria are met by the concept of sustainable intensification of agricultural production.

The dissemination of the principles of sustainable development in agriculture can only occur in the event of acceptance of environmentally friendly practices by farmers. A farmer deciding to undertake a specific agricultural activity (cultivation or breeding), or designating obtained products for food or non-food purposes, is primarily guided by economic criteria. In the globally dominant industrial agriculture, holdings are mainly occupied with trade, which means that income is one of the basic criteria for justifying the selection of certain agricultural practices[1].

[1] The author is aware of the existence of a (globally) large number of small holdings, whose operation is essential to ensure food security of local communities. However, their role in the modern economy is being marginalised, which means that the main focus for sustainability

The evaluation of profitability that takes into account the environmental aspects of activities requires a proper study of productivity. In effect, the matters of productivity and profitability are the basis for making agriculture sustainable, including agricultural holdings.

Productivity and profitability indexes of agricultural holdings provide relevant information that can be used as a basis to assess the functioning of a farm. Comparing environmentally friendly and unsustainable practices and indicating economic benefits arising from the protection of the environment can be an effective tool for the promotion of sustainable development. However, such a comparison requires a more complex approach to the problem of productivity and profitability of agriculture, taking into account a number of factors considered to be externalities.

The purpose of this study is to compare productivity and profitability selected groups of farms characterised by the use of environmentally friendly agricultural practices.

This study has been developed on the basis of a critical analysis of available literature and – in the empirical part – on the basis of own research of selected form of the sustainability of agricultural holdings. The results of own research were previously published in Polish [Prandecki et al. 2014].

1. Productivity in agriculture

Productivity can be most easily defined as the quotient of a single output and individual input [Farrell 1957]. Such a formulation is very general and causes a lot of controversy. In Polish literature dedicated to the economics of agriculture, a distinction between **production and productivity** is often drawn. The first of these terms refers to the comparison of the output (production) to the inputs, measured in natural values. Such a formulation allows to specify the technical performance of a given production factor. Productivity is the same relationship, but converted to values [Manteuffel 1984]. In practice, this division is becoming less used, because in most cases productivity is treated as both the volume and value of production per unit of input [Kulikowski 2012].

Productivity can be provided in average values, i.e. express the ratio of outputs to the average value of inputs for a given period, and in marginal values, showing the ratio of the increase of production value to the increase of input value during the same period.

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should be placed on larger entities. Such a position is not synonymous with a total disregard for small farms, and only with the conviction that the state can more effectively implement the expected attitudes through emphasis on larger farms.

The primary tool for assessing productivity is the analysis of main production factors, namely capital, labour and land[2]. Productivity is determined by dividing the value of production and the amount of resources [Harasim 2006], i.e.:

- productivity of labour resources = production/labour resources,
- productivity of land resources = production/land resources,
- productivity of capital resources = production/capital resources.

In a similar way, one may analyse the value of production compared to production inputs. In this way, we obtain [Harasim 2006]:

- productivity of labour inputs = production/labour inputs,
- productivity of capital inputs = production/capital inputs,
- productivity of land inputs = production/land inputs.

Land productivity is the most commonly used indicator in agriculture. It allows to determine the size of agricultural production of the utilized agricultural area. This indicator does not apply in estimating production from orchards (except for production using row spacing) and in the case of breeding granivorous animals. Measuring productivity of fruits mostly takes place using the number of trees or shrubs [Kulikowski 2003]. In turn, breeding granivorous animals is often not associated with owned land, which causes that its area has no impact on the scale of production.

The most commonly used measure of area in studying land productivity is a hectare of agricultural land. The manner of land classification is of vital importance when interpreting data on land productivity. In studies based on mainstream economy, agricultural area is accepted as an input. This causes that other elements, such as gardens and forests are not taken into account. In the case of incorporating environmental aspects in agricultural activity and other based on farm assets, the holding's production should be analysed in the context of all owned lands.

The **productivity of labour** is another important indicator. Apart from agriculture, it is the most widely used type of productivity [Hall and Taylor 1997]. It is also often used in agriculture, as it allows to determine the volume or value of output per worker.

In turn, the value of agricultural production to capital inputs ratio is defined as **productivity of capital** or the productivity of capital inputs. In this case, too, there are different methods of calculating inputs, which makes it necessary to evaluate inputs when comparing the results of different studies.

In addition to partial productivity indicators, their integrated forms are used, showing the overall relationship between benefits and expenditures. The

[2] For more information on production factors see [Baer-Nawrocka 2013].

first indicator of this type used in agriculture is considered to be the ranking coefficient, introduced by M.G. Kendall in 1939. In addition, the following were used, among others: Index of productivity coefficient of agriculture, Productivity evaluation index, Weighted rank index and the Agricultural productivity coefficient index. Today, the most commonly used index for this purpose is the Total Factor Productivity index – TFP. It is calculated as the sum of outputs and inputs used in the production process. Results obtained in this way are considered to be the most widely used productivity index in agriculture. This is due to its complexity, i.e. the total analysis of inputs in agriculture. Depending on the needs, different methods of TFP analysis are used. In the case of statistical comparisons, applied agricultural practices or the managed area, among others, can be used as criteria of aggregation.

In addition to TFP, Data Envelopment Analysis (DEA) can be used to measure overall productivity and the Cobb-Douglas function. DEA is used to directly compare outputs and inputs, indicating the best results. The condition for its application is the technological uniformity of facilities under study [Domagała 2007]. The Malmquist or Tornqvist-Theil productivity indexes are mainly used under this method. Both are based on the assumption that the growth of outputs occurs as a result of increased inputs [Melfou et al. 2007].

In turn, the Cobb-Douglas function can be used to clarify a situation, in which the increase in outputs cannot be attributed to the increase in inputs (the change is disproportionate or the increase in outputs is not accompanied by increased inputs). Typically, in such cases the obtained outputs significantly exceed inputs incurred. These phenomena can be explained by changes in technology, the impact of economies of scale, the increase in production efficiency and the lack of inclusion of *quasi-permanent* inputs in the analysis [Melfou et al. 2007].

These total productivity indexes do not take into account environmental factors. For this reason, measures were taken for their extension. The most successful effects of such work are considered to be two indicators based on TFP, i.e. **Total Resource Productivity (TRP)** and **Total Social Factor Productivity (TSFP)**.

TRP is used to assess how does society allocate scarce resources. This means that it ignores other aspects of agricultural production associated with the environment, such as the impact of environmental services[3], biodiversity loss,

[3] Environmental services are benefits to humans resulting from the functioning of the ecosystem [TEEB 2010]. In the *Millennium Ecosystem Assessment* – MEA [2005], considered to be the basic document on environmental services, they are referred to as the benefits for

or changes in the landscape. In turn, TSFP is an extension of the classical TFP through the inclusion of selected externalities, both on the side of production and inputs. In practice, environmental external inputs are used to calculate TSFP more often than outputs.

The literature notes that TSFP is more useful for the assessment of sustainable agriculture, however its use is significantly limited by the need for economic valuation of environmental values considered to be effects and inputs included in the productivity account. Experiments show that there are significant differences in this area.

Moreover, many doubts are related to the selection of factors (inputs and outputs) taken into account in assessing productivity. Typically, due to problems with valuation, TSFP includes only a limited number of factors, for example, only one or two. This causes that productivity calculated in such a way is still fragmentary in nature.

Both TFP in its classical form, as well as TRP and TSFP are only partially useful in the analysis of sustainable agriculture. They allow to study partial phenomena, mainly those that degrade the environment, but they do not include the benefits that come from the use of environmentally friendly farming practices. However, the use of more complex indicators, e.g. **Agricultural Sustainability Index** (ASI), proposed by Nambiar's team [2001] seems to be too complex to be useful in assessing productivity of the farm. This indicator takes into account: the production of crops, soil quality, biodiversity, energy balance, nutrient balance, agro-ecological quality (the balance of agrosystems' functioning in the long term), as well as socio-economic factors (methods of management in agriculture, the knowledge of agricultural techniques and productivity).

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humans that are derived directly or indirectly from ecosystems. The most commonly used classification of environmental services is the following [MEA 2005]:
1. basic (supporting services), necessary to provide all other categories of services that influence life on Earth, e.g. photosynthesis, primary production, soil creation, natural cycles of elements and substances affecting life (carbon, oxygen, water);
2. provisioning services (production services), e.g. food, wood, fibre, biofuels;
3. regulating services – such as the absorption of pollutants, climate change, mitigation of flood wave, water purification, waste disposal, etc.;
4. cultural services – intangible benefits obtained by humans through e.g. aesthetic, recreational, religious, cultural diversity, a sense of territorial belonging, the perception of natural and cultural heritage, impact on education, creative inspiration, artistic sense, recreation and tourism.
Environmental services of relevance to agriculture include, among others, regeneration processes, retention and water purification, oxygen production and pollination of plants. More on environmental services see: [Buks and Prandecki 2014].

The analyses' ambiguity cause that indicators such as TRP, TSFP and ASI are characterised by low usefulness to assess the productivity of sustainable agriculture. For this reason, it appears advisable to search for new and more adequate tools to measure it. In particular, this relates to the expansion of the number of outputs, such as the benefits of absorption of greenhouse gases, for example.

Modern economy is based on the assumptions of neoclassical economic theory, resulting in the inability to achieve complete sustainability based on ecological economics and the restrictive principle of permanence. Therefore, the discussions on the sustainability of agriculture have to assume the soft or strong form of this principle[4]. This approach allows the **analysis of agricultural productivity in terms of sustainability** to be carried out in two ways. Firstly, **specific agricultural practices** (more or less) **compliant with the criteria of sustainable agriculture** can be assessed. Such practices or holdings using them may be analysed using the previously mentioned productivity indicators, i.e. land productivity or TFP. Secondly, it is possible to create, based on existing research methods, **a new tool for assessing productivity**. Its key feature would be the inclusion of factors known as externalities both on the side of outputs (benefits) and inputs[5]. Their selection should take into account (in addition to the previously analysed variables) both the environmental and social aspects of agricultural production.

[4] The author distinguishes four basic forms of the principle of permanence, i.e.: weak, soft, strong and restrictive. They differ from each other in the degree of the relationship between different types of capital (mainly natural capital and one processed by man). The weak rule is the weakest. It means the preservation of only the size of the total capital, irrespective of its structure (natural, produced by man and social capital). The soft principle requires, in addition to the preservation of the total size of the capital, that a certain rule that specifies the relationships between the components remains intact. The strong rule denotes the preservation of each type of capital (each separately), because it is considered that the natural capital and one produced by man are not substitutable. The restrictive rule is the strongest and it includes the prohibition to drain any non-renewable resources. In addition, it allows the use of renewable resources only to the limit of re-creation of a resource [Borys 2005]. Theoretically full sustainability can only be achieved in the case of the restrictive principle. In other cases, the applied sustainability criteria are limited and do not reflect full sustainability. However, they are the most adequate solution available today.

[5] Externalities are the unintended consequences of operation by managing entities. An externality arises in situations where the process of production or consumption of a good or service, run by a single entity, has a direct impact on decisions taken by other bodies (production or consumption). This process takes place outside the market mechanism. This means that "the function of usefulness or the production function of some entities, contains variables, whose values do not depend on them, but other actors" [Zegar 2010, p. 252]. Externalities may have the form of benefits (desirable) or a disadvantage (undesirable). In the latter case they cause harm to others (producers or consumers), unrelated to their production.

In the first of these methods, one can distinguish appropriate ranges of sustainability, depending on the number of fulfilled criteria and the degree of their implementation. It allows to take into account externalities without the need for their valuation. The selection of factors taken into account depends on obtaining data for research. At this stage, there is a wide possibility to use knowledge from other fields, such as climatology, cultivation technology or animal sciences. The already mentioned environmental services are an example of such criteria, such as providing a positive balance of organic matter in the soil, proper fertilization and maintenance of green areas. Moreover, one can distinguish other factors unrelated to services, but having an impact on the environmental and social aspects of agriculture. These include: the relationship between plant and animal production, the structure of agricultural crops, production allocation (what share of production is to be allocated to non-food purposes), etc. The number of criteria used may be large, but it is worth remembering that the more complicate the analysis, the harder it is to distinguish an entity applying a particular group of practices, and thus calculate the productivity of such complex processes. The selection of evaluation criteria under this method is also dependent on access to statistical data, enabling the separation of thresholds and entities applying such practices. The advantage of this approach to evaluate productivity of agricultural practices considered to be sustainable is the ease of use of this indicator and the transparency of its calculation, allowing it to be quickly used in the process of creating a state's economic policy. Study results obtained in this way can be used to develop a support instrument based on the differences in productivity levels of various forms of agriculture.

The second approach to the productivity of sustainable agriculture, that is, the creation of a new tool for assessing productivity is more complicated. The challenge is to create an appropriate directory of externalities that should be taken into account in studying productivity. Their classification poses another question. In the case of environmental services, many processes can be assessed as outputs and inputs at the same time. The lack of a universal, unambiguous classification causes difficulties in interpreting the results. In the case of comparisons, it is necessary to examine the method of construction of an index in order to determine individual services (output or input) and the strength of its impact.

In addition, the methods of **valuating externalities** rise doubts. The failure to include such costs and benefits in market exchange processes makes the applied valuation methods very imprecise. In different analyses, the same effect can have radically different values. An example includes the estimates of costs related to climate policy, where the method changes with each study. The

same is true for the valuation of insect pollination. The effects of productivity drops in the absence of pollinating insects are estimated differently on a global [Gallai et al. 2009] and national level [Majewski 2014]. The evaluation of productivity based on such fragile foundations is hardly credible.

There are many similar examples of ambiguity in the valuation of externalities. They show that the studies of sustainable agricultural productivity based on a new productivity index are still premature. However, research works on the valuation of externalities and common goods must continue.

It should be stressed that complete sustainability can be achieved only where the second solution is applied. The productivity index of applied agricultural practices (the first method) provides information that facilitates the decision whether to put a holding on the road towards sustainable development. The processed range of information, however, is limited, which makes it impossible to measure full sustainability, but its calculation and the application of appropriate practices brings this goal closer and allows to avoid many types of risks that may occur in the future.

2. Profitability in agriculture

Profitability is one of the measures of the effectiveness of used resources. As in the case of productivity, in agriculture, one can calculate the profitability of labour, land and capital. The basis of assessment is the amount of income per given unit of production factor involved. In the case of labour profitability, it is the income divided by labour resources, in terms of land profitability it is the income divided by land resources. In turn, the profitability of capital is income divided by capital resources [Harasim 2006].

Income is the primary goal of farmers' economic activity. It is determined in gross values, i.e. through the difference of production value and actual costs (direct and indirect), as well in net values – by deducting the value of depreciation from gross income. The amount of income influences the standard of living of the entire family, which is why it is a strong indicator of the situation on the farm. In analogy, profitability is also one of the basic criteria for decisions made by the farmer. For this reason, the effectiveness of measures undertaken in the name of sustainable development is dependent on the level of profitability. From the point of view of a farmer, it should be assumed that profitability of their work will have the largest influence on their decisions. In the context of sustainable development, the profitability of land is also worth examining, because along with the increase in population, land becomes an increasingly limited resource.

Studying the profitability of sustainable agriculture requires, as in the case of productivity, the need for searching not only the economic optimum, taking into account the monetary values resulting from the market's operation, but also the social optimum, which takes into account externalities of non-commercial, post--market nature. As previously mentioned, the internalisation of external effects is very difficult and involves a number of uncertainties. Most environmental externalities should be taken into account in the economic balance. Additionally, the calculation of income and profitability takes into account money transfers resulting from government policy. They can include benefits (e.g. subsidies, grants) or costs (e.g. payments for undesirable behaviour). In this way, the economic balance of a holding may reflect not only the environmental aspects of sustainable development, but also social ones. Such a balance will not conform to the assumption of *homo oeconomicus* and the economic optimum, but it will strive towards a social optimum and sustainable development.

As in the case of productivity, profitability can be calculated in two ways, i.e. through relative differences in income levels of holdings using appropriate agricultural practices and by attempting to evaluate certain externalities. Analogously to the previously mentioned reasons, it appears that it is more reasonable to apply the first one. It is worth remembering that this method is imperfect, since it ignores many externalities important from the point of view of permanence and sustainable development. However, its use provides data enabling many households to make the decision to enter on the path towards sustainable development. With the advancement of science and knowledge in the field of sustainable agriculture, the clarification of research methods is advisable.

3. Productivity study of selected sustainable forms of agricultural holdings in 2012

3.1. Test method

The analysis uses data from 2012 concerning individual commercial farms included in the Polish FADN. The aim was to determine the level of productivity of selected forms of sustainable agriculture, taking into account their area and the specificity of agricultural production.

In the course of theoretical considerations, it was decided that the most adequate method for measuring the productivity of agriculture in the context of sustainable development is to isolate groups of holdings using appropriate farming practices that promote sustainability of agriculture. The adopted criteria correspond to the soft variant of the principle of sustainability. In addition, it is worth noting that the analysis omits the social aspects of sustainability. This is

due to the formula used, i.e. the exclusion of the impact of common goods and externalities, and the difficulty in assessing the impact of social aspects on agricultural production.

The subject of the study was agricultural holdings with an economic size equal to or greater than EUR 4,000 of Standard Outputs (SO)[6]. A control group was isolated during the preparatory process. For this purpose, **specialized farms** were excluded from the study. This group includes farms focused primarily on animal production, in which traditional crop production was reduced (i.e. arable land of small area, less than 1 ha). Units focused exclusively on animal production (poultry farms, mainly poultry of high animal production scale) and holdings in which mainly permanent pastures and/or orchards have been used, were classified to this group. Specialized farms differ in terms of production and economic results from ordinary units, therefore they have been isolated from the entire group of agricultural holdings as a separate group.

As a result only **comparative farms (CF)** have been used for the purposes of the actual analysis. To this group belong holdings with at least 1 ha of arable land. The results of comparative farms constituted a reference to the four forms of sustainable agriculture in this analysis. These holdings were also divided into four groups characterised by the use of environmentally friendly agricultural practices. These forms of sustainability have been the subject of earlier studies [Toczyński et al. 2013; Wrzaszcz and Zegar 2014], which means that an existing method of identification has been used. In particular, this relates to the last of the following groups:

- **Organic farms (ORG)** – This group included both farms possessing a certificate issued by an approved certification body, as well as those in the process of adjusting to the system of agricultural production. The guiding principle in the eco-friendly system is the cultivation of plants according to the standards of good agricultural practice, with due attention to the phytosanitary condition of plants and soil protection. The need to maintain permanent grasslands and landscape elements not used for agricultural purposes is also included as a requirement. These farms operate on the principles laid down in the Polish and EU regulations[7].

[6] Standard Output calculated using SO coefficients shows the potential of farm production. The coefficients are calculated as an average for each activity without the distinction between production technology, therefore, they do not faithfully specify the situation of a farm with e.g. organic production. For this reason, the analysis was based on the production actually produced on the farm.

[7] A list of the legislation from the scope of the environmental management system can be found at the website of the Ministry of Agriculture and Rural Development: http://www.minrol.gov.pl/pol/Jakosc-zywnosci/Rolnictwo-ekologiczne/Akty-prawne.

- **Agri-environmental farms (AEF)** – farms participating in the agri--environmental programme recognized in the Rural Development Plan for 2007-2013 (RDP 2007-2013)[8]. The implementation of this programme was to contribute to the sustainable development of rural areas and the preservation of biodiversity in these areas. The main idea was to promote agricultural production based on methods conforming with the requirements of environmental protection.
- **Norfolk farms (NORF)** – these farms are characterised by rich structure of field crops, which positively affects soil fertility and allows to use crop rotation called the "4-course system". The structure of sowing in the Norfolk system includes 50% of cereals, 25% of structure-forming processes (legumes, fodders) and 25% of root plants. For the purposes of this study, the following is assumed:
  - crops on arable land: 100% – the area of crops on arable lands is defined as the difference between used arable land and the area of fallow land and set-asides on these lands;
  - the share of cereals in the crop structure: a maximum of 60%;
  - the share of structure-forming plants in the crop structure: a minimum of 20%;
  - the share of other crops in the crop structure: a maximum of 20%.
- **Sustainable farms (SUST)**[9] – these farms have met the four adopted criteria of environmental friendliness of agricultural production. Agricultural production with respect to natural resources allows for skilful rotation (multi-species crop rotations) and fertilization of plants adapted to soil type and fertility. As the criteria of environmental sustainability of farms, the following have been adopted [Wrzaszcz 2012]:
  - the share of cereals in the crop structure on arable land: a maximum of 66%;
  - the number of plant groups cultivated on arable land: a minimum of 3 – from groups: cereals, legumes, root crops, oil plants, grasses on arable land; other (other species not included in the above mentioned groups);

[8] The RDP 2007-2013 document, including a detailed description of the agri-environment measures and the relevant legal regulations, is posted at the website of the Ministry of Agriculture and Rural Development: http://www.minrol.gov.pl/pol/Wsparcie-rolnictwa-i-rybolowstwa/PROW-2007-2013/Dokumenty-analizy-raporty.

[9] Contrary to the adopted name, these holdings are not fully balanced, however, the study assumes that compliance with the provisions of the concept of sustainable development is large enough to accept the name.

- arable land vegetation cover index during the winter: a minimum of 33% – this index was calculated as the ratio of the sum of winter cereals area to the harvest in the following year, catch crops on arable land to the harvest/ploughing in the following year, grasses cultivated green in the open, small-seeded legumes harvested green, mixtures of legumes and grasses and the sown area on arable lands;
- stocking density on agricultural land: up to 2 livestock units per hectare of used agricultural land – this index allows for ecological assessment of farm organisation, because it provides information about the level of intensity, and also indicates the scale of natural fertilizers burden on the environment [Kuś 2006]. This limitation is due to the potential for exceeding animal manure absorption by the agro-ecosystem [Faber et al. 2010].

It should be emphasized that the above sets are not severable. For example, this means that sustainable farms can be simultaneously qualified to other groups, e.g. in the case of using agri-environment schemes.

In addition, a group of **cereal farms** has been distinguished (FADN specific type: STF 151). The full name of these types of farms is "specialist cereals (other than rice) oilseeds and protein crops". In view of the fact that a predominant part of these farms were focused on the production of cereals, their designation has been shortened to "cereal farms"[10]. The narrow specialisation of crop production in these farms (monoculture or crop production with low species diversity) indicates agricultural practices far removed to those recognised by the principles of sustainable development of agriculture. For this reason, they can be considered unsustainable. Such an approach enables the identification of differences in productivity between industrial and sustainable agriculture.

After a general analysis of selected forms of sustainable agricultural production against comparative and cereal farms, they have also been tested in a more detailed manner, namely, taking into account their area (the area of used agricultural land) and the specificity of agricultural production, determined using the so-called "type of farming". The analysis was based on the output actually produced on the farm. For the purposes of this study, the following groups of farms have been established in terms of size:

- less than 1 ha of agricultural land – this group also includes farms without agricultural land,
- 1-4.99 ha of agricultural land,
- 5-24.99 ha of agricultural land,

[10] Rules for the classification of farms to the various types of agricultural production were presented in detail in publications [Goraj et al. 2010; Goraj et al. 2012].

- 25-49.99 ha of agricultural land,
- 50 ha of agricultural land and more.

In addition, the analysis was conducted in terms of types of individual farms:

- specializing in field crops (type 1),
- specialized in horticultural crops (type 2),
- specialized in permanent crops (type 3),
- specialized in rearing grazing animals – grass-fed animals (type 4),
- specializing in rearing granivores – granivorous animals (type 5),
- various crops (type 6),
- various animals (type 7),
- various crops and animals together (type 8).

On the basis of the above groups, an analysis of productivity and profitability has been conducted. An index analysis and comparative analysis have been used. The following indexes have been considered the most important:

- Indexes based on the value of production of an agricultural holding is the primary production and economic category indicating the result of farming. This value is included in the following indexes:
  - production value/hectare of agricultural land – used to assess the productivity of land inputs,
  - production value/person working full-time in total – used to assess the performance of labour inputs,
  - the share of crop and livestock production in the total value of production – points to the importance of a defined direction of agricultural production in the total value of production of an agricultural holding.
- The income from a family agricultural holding is the primary economic goal of farmers' activities, and is an important determinant of the standard of living for farming families, therefore it can be an important indicator of the efficiency of farms in agriculture [Wrzaszcz and Zegar 2014]:
  - income/hectare of agricultural land – used to assess the profitability of engaged unit of land,
  - income/person working full time on their own – used to evaluate the profitability of own work (unpaid, family members).

3.2. Study results

The study was carried out on a group of 10,589 comparative farms. Almost half of them (5,213) ranged in the 5-25 ha group, and the least were in the 1-5 ha group – 212 units (Table II.1).

Table II.1. Comparative farms[a] according to the size of agricultural area

No.	Description	In total	1-5 ha	5-25 ha	25-50 ha	≥ 50 ha
	General characteristics: the numbers and basic characteristics of an average farm					
1	Numbers	10,589	212	5,213	3,074	2,090
2	Share in the total FADN community (%)	97	77	97	100	100
3	Share of the farms in the study (%)	100	2	49	29	20

[a] comparative farms are entities in which arable land of at least 1 ha was used. The group of comparative holdings was determined by deducting the number of specialized farms from the number of individual farms

Source: Prandecki et al. 2014, p. 104.

Among the various forms of farming sustainability, the group of farms benefiting from agri-environment programmes was the largest, i.e. almost 2,500 farms – 23% of the FADN community (Table II.2). Farms belonging to the sustainable group composed a slightly smaller group – approximately 2,300 farms (21%).

A comparison of farms by area groups shows that the share of four tested forms of sustainable agriculture is greater in larger farms. In the case of sustainable holdings, this share amounted to 8% in the group of 1-5 hectares, 16% – 5-25 ha, 27% – 25-50 ha and 28% – 50 ha and more [Prandecki et al. 2014].

Agri-environmental farms were also characterised by a relatively large area of agricultural land (45 ha per farm on average), slightly higher than sustainable farms with an average area of 44 ha/farm in this respect. Cereal farms were the largest in terms of area, with an average area of 75 ha per farm. The obtained results indicate the interest of Polish farmers in caring about the environment. A difference in the degree of interest depending on the size of the farm is noticeable. This may indicate that it is easier to meet the criteria of sustainability for larger farms.

The study was conducted from the point of view of economic optimum. Average results for particular groups of holdings (Table II.2) indicate a lower land productivity of environmentally-friendly agricultural practices. This applies to all area groups, although in some cases the differences were small (Figure II.1). This disadvantage is especially evident in the case of organic farms that obtained significantly worse results from other forms of agricultural sustainability. Land productivity of agri-environmental, Norfolk and sustainable holdings in each case was higher than in the group of cereal farms.

Table II.2. Farms by various forms of sustainability against comparative[a] and cereal farms[b]

No.	Description	CF	CER	ORG	AEF	NORF	SUST
I	**General characteristics: the numbers and basic characteristics of an average farm**						
1	Numbers	10,589	1,389	422	2,487	1,540	2,309
2	Share in the total FADN community (%)	97	13	4	23	14	21
3	Share of the farms in the study (%)	100	13	4	23	15	22
4	Agricultural area (ha/farm)	37	75	37	45	36	44
5	Working (AWU/farm)	2.01	1.70	1.89	1.96	2.06	2.05
6	Animals (LU/farm)	27	2	14	27	31	26
7	Total assets (thousand PLN/farm)	1,271	1,878	926	1,409	1,294	1,527
8	Standard gross margin (ESU/farm)	22	22	13	23	22	23
II	**Costs, subsidies, production and income on average per farm**						
9	**Standard Output (euro/ha)**	**1,275**	**650**	**898**	**1,105**	**1,300**	**1,145**
10	Standard Output (euro/AWU)	23,326	28,542	17,810	25,533	22,856	24,733
11	**Agricultural farm production (PLN/ha) [12+13+14]**	**7,303**	**4,700**	**3,083**	**6,044**	**6,611**	**6,501**
12	plant production (PLN/ha)	3,865	4,561	1,758	3,452	2,297	3,579
13	animal production (PLN/ha)	3,382	102	1,240	2 527	4,247	2,872
14	other production (PLN/ha)	56	37	86	66	67	51
15	Production from agricultural farm (PLN/AWU)	133,610	206,265	61,138	139,708	116,192	140,453
16	Intermediate consumption (PLN/ha) [17+18]	4,331	2,397	1,756	3,647	3,855	3,636
17	direct costs (PLN/ha)	3,198	1,610	1,022	2,666	2,733	2,563
18	farming overheads (PLN/ha)	1,133	787	734	981	1,122	1,073
19	Balance of subsidies and taxes from operations (PLN/ha)	932	895	1,378	1,323	1,005	960
20	**Gross value added (PLN/ha) [11-16+19]**	**3,903**	**3,197**	**2,705**	**3,721**	**3,762**	**3,825**
21	Depreciation [PLN/ha]	885	575	606	773	918	827
22	**Net value added (PLN/ha) [20-21]**	**3,018**	**2,622**	**2,099**	**2,947**	**2,844**	**2,998**
23	Net value added (PLN/AWU)	55,220	115,073	41,624	68,123	49,978	64,777
24	Costs of externalities (PLN/ha) [25+26+27]	335	256	302	298	326	318
25	remunerations (PLN/ha)	143	61	172	103	132	107
26	rents (PLN/ha)	98	116	70	97	86	111
27	interest (PLN/ha)	94	79	59	98	108	100
28	Balance of payments and taxes from investing activities (PLN/ha)	-172	-139	-81	-162	-190	-192
29	**Income per holding (PLN/ha) [22-24+28+V*]**	**2,731**	**2,409**	**1,834**	**2,718**	**2,605**	**2,747**
30	Income per holding (PLN/FWU)	57,699	120,288	44,620	71,311	52,027	66,805

[a] Comparative farms are entities, in which arable land of at least 1 ha was used. The group of comparative holdings was determined by deducting the number of specialized farms from the number of individual farms; [b] cereal farms are farms specialised in cultivating cereals, oilseeds and protein crops. They are characterised by unsustainable agricultural production, which means that they have served as a reference point for the studied forms of sustainability.

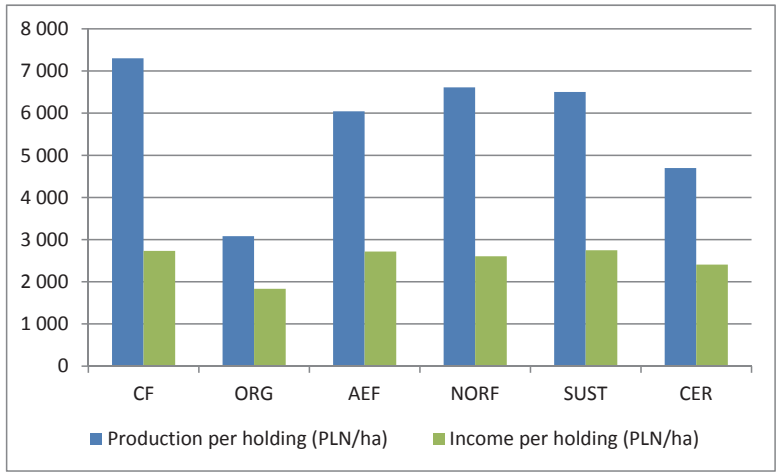
CF – comparative farms; CER – cereal farms; ORG – organic farms; AEF – farms using agri-environmental programmes, NORF – Norfolk farms, SUST – sustainable farms

* V – settlement of VAT with the Tax Office

Source: Prandecki et al. 2014, p. 106.

In all area groups, pro-environment holdings incurred lower direct and farming overheads in relation to comparative holdings, calculated per unit of area. Moreover, these holdings – in most cases – were characterised by lower depreciation costs and higher subsidies. All this contributed to the differences between land productivity and its profitability. For this reasons, land profitability in these holdings achieved a better ratio in comparison to comparative holdings than land productivity.

Figure II.1. Land productivity and profitability of selected forms of sustainable agriculture against comparative and cereal farms



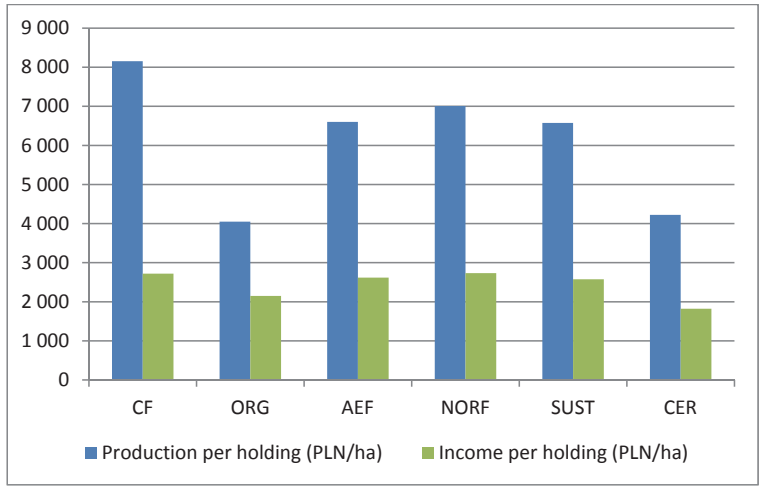
CF – comparative farms; ORG – organic farms; AEF – farms using agri-environmental programmes, NORF – Norfolk farms, SUST – sustainable farms; CER – cereal farms

Source: Prandecki et al. 2014, p. 77.

In the case of the largest holdings implementing agri-environmental programmes (Figure II.4), Norfolk farms with an area of 5-25 ha AL (Figure II.2) and holdings with sustainable plant and animal production with an area of 25 ha AL and more (Figure II.3), the income from family agricultural holdings obtained per area unit was higher than in comparative farms. Income generated by organic farms were definitely smaller than other farm groups, despite a large financial support in the form of state subsidies for this agricultural production system.

A high level of land productivity was present in the smallest groups of farms, i.e. in the 1-5 ha AL range (holdings smaller than 1 ha of arable land were excluded from the study). The achieved results are significantly different from the other, which is due to the inclusion into this group farms earning income from other activities, e.g. animal husbandry or horticulture. However, even in such a case the productivity of organic farms was by far the lowest.

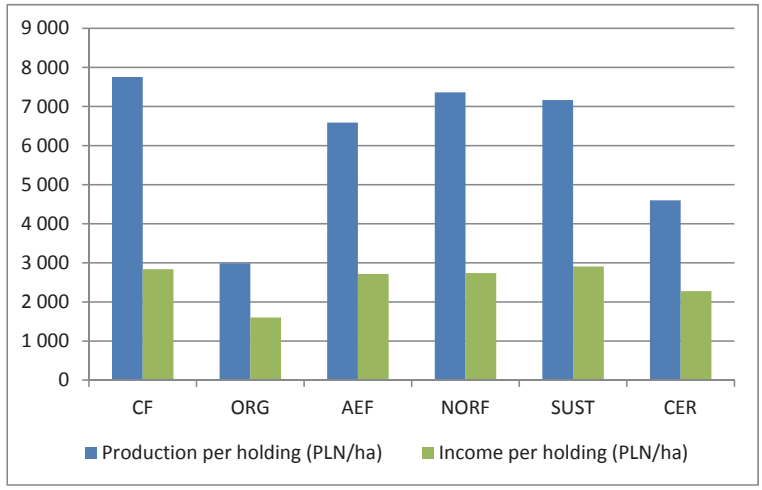
Figure II.2. Land productivity and profitability of selected forms of sustainable agriculture, as well as comparative and cereal farms in the area group of 5-25 ha



CF – comparative farms; ORG – organic farms; AEF – farms using agri-environmental programmes, NORF – Norfolk farms, SUST – sustainable farms; CER – cereal farms

Source: Prandecki et al. 2014, p. 80.

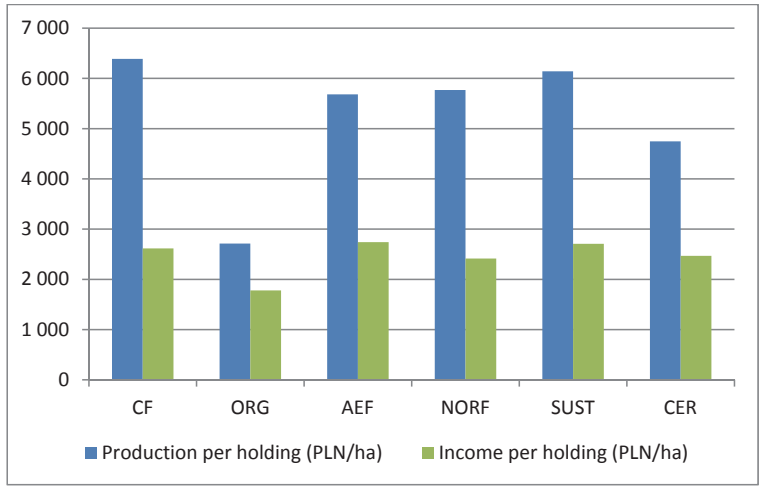
Figure II.3. Land productivity and profitability of selected forms of sustainable agriculture, as well as comparative and cereal farms in the area group of 25-50 ha



CF – comparative farms; ORG – organic farms; AEF – farms using agri-environmental programmes, NORF – Norfolk farms, SUST – sustainable farms; CER – cereal farms

Source: Prandecki et al. 2014, p. 80.

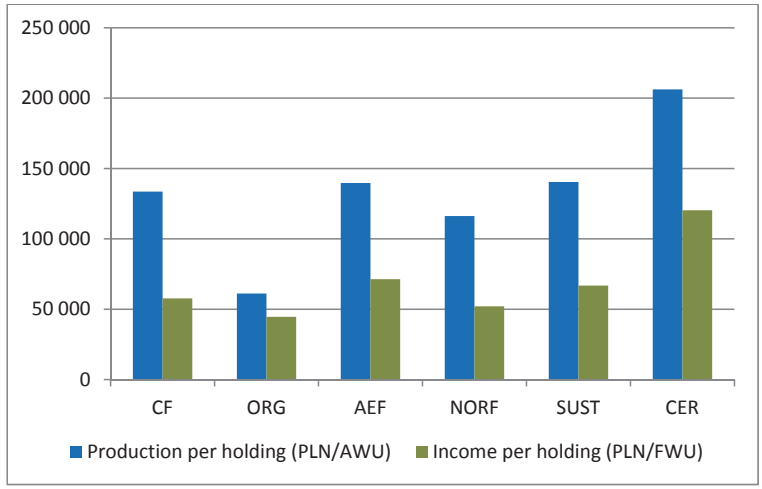
Figure II.4. Land productivity and profitability of selected forms of sustainable agriculture, as well as comparative and cereal farms in the area group of 50 ha and more



CF – comparative farms; ORG – organic farms; AEF – farms using agri-environmental programmes, NORF – Norfolk farms, SUST – sustainable farms; CER – cereal farms

Source: Prandecki et al. 2014, p. 80.

Figure II.5. Labour productivity and profitability of selected forms of sustainable agriculture against comparative and cereal farms



CF – comparative farms; ORG – organic farms; AEF – farms using agri-environmental programmes, NORF – Norfolk farms, SUST – sustainable farms; CER – cereal farms

Source: Prandecki et al. 2014, p. 77.

In terms of labour productivity (Figure II.5) one can notice greater labour efficiency in sustainable farms and farms implementing agri-environmental programmes. Labour productivity in this groups was higher than the average for the whole group of comparative holdings. This advantage stemmed mainly from the larger agricultural area utilised by a comparable number of workers. However, within each area groups, an advantage on part of the comparative group is noted. In addition, it is worth noting that in this category the best results were achieved by cereal farms, which was caused, first and foremost, by their area (economies of scale) and relatively lower labour inputs.

Productivity results also translate to profitability. Income per unpaid person working full time in agri-environmental and sustainable farms was higher than in the comparative group, regardless of their area. In other forms of sustainability, labour profitability increased together with area of holdings, which is typical for agriculture. It shows that farmers chose practices not only because of their environmental criteria, but above all for the sake of their own benefits. As in the case of land productivity, organic farms obtained significantly worse results.

Analysis carried out in terms of types of agricultural holdings showed that the highest land productivity, in relation to comparative holdings, was achieved by Norfolk farms with mixed crop production (Table II.3). Sustainable farms: specialising in field crops (type 1), specialised in rearing roughage-fed animals (type 4) and not specialised with mixed animal and plant production (type 8) surpassed comparative holdings both in terms of land and labour productivity. Land and labour profitability was also higher in these farms, despite incurring higher production costs (Table II.4). These costs were somewhat compensated by higher subsidies. The relationships between labour productivity in holdings of studied sustainability forms to labour productivity in comparative holdings was in most cases more favourable than the land productivity relationship. Nevertheless, in many cases the results of studied forms of sustainable farming were lower than those achieved by comparative holdings.

Organic farms were characterised by the least favourable results, regardless of the grouping criterion. The economic situation was improved by obtained subsidies (the balance of payments and taxes to operations in the vast majority of cases was the highest among all surveyed groups), however they did not fully compensate for low production results. It should be noted that in connection with the inclusion of adjusting holdings to this group, the results were lower than those achieved only by certified holdings. A farm during the adjustment period must comply with the principles of organic farming, while selling products on the conventional markets, obtaining lower prices than after obtaining the certificate.

Table II.3. Land and labour productivity of various forms of sustainable farming by type of farming

No.	Description	CF	ORG	AEF	NORF	SUST
Land productivity (PLN/ha)						
1	Specializing in field crops (type 1)	5 169	2 327	4 828	4 082	5 565
2	Specialized in horticultural crops (type 2)	42,046	-	-	-	-
3	Specialized in permanent crops (type 3)	11 585	3 105	4 015	-	-
4	Specialized in rearing grazing animals – grassfed animals (type 4)	7 283	2 333	5 498	7 134	7 414
5	Specializing in rearing granivores – granivorous animals (type 5)	17 957	-	15 007	14 498	-
6	Various crops (type 6)	7 631	4 720	3 907	9 613	6 482
7	Various animals (type 7)	7 626	4 818	6 993	6 962	7 114
8	Various crops and animals together (type 8)	6 238	2 962	6 004	5 724	6 672
Labour productivity (PLN/AWU)						
1	Specializing in field crops (type 1)	156 224	76 010	169 230	108 853	189 031
2	Specialized in horticultural crops (type 2)	105 799	-	-	-	-
3	Specialized in permanent crops (type 3)	66 804	51 644	55 682	-	-
4	Specialized in rearing grazing animals – grassfed animals (type 4)	116 094	41 364	98 787	120 865	126 307
5	Specializing in rearing granivores – granivorous animals (type 5)	304 563	-	312 293	325 079	-
6	Various crops (type 6)	62 898	38 660	54 661	53 614	90 623
7	Various animals (type 7)	100 170	51 682	109 403	85 912	95 245
8	Various crops and animals together (type 8)	107 154	52 106	118 674	110 410	128 594

CF – comparative farms; CER – cereal farms; ORG – organic farms; AEF – farms using agri--environmental programmes, NORF – Norfolk farms, SUST – sustainable farms

Source: Prandecki et al. 2014, p. 105, 111-117.

Cereal farms are inherently not in the position to implement sustainability principles, due to a too simplified crop-rotation. In these holdings, land productivity was lower than the results of most farms operating according to environmentally friendly principles. Only organic farms have developed worse economic and production results. The production scale made a very clear mark in this group. In the case of cereal farms, the largest in terms of area (more than 50 ha), labour productivity was higher than on strictly specialised farms, due to higher production value and lower involvement of the labour factor. Labour profitability, regardless of area groups, was higher on farms using a simplified crop rotation.

The obtained results show lower productivity of sustainable forms of agriculture. Taking into account state policy in the profitability balance causes that in many cases the differences are mitigated, and in some cases sustainable farms achieve higher incomes than comparative farms. This difference is

rather small. This information leads to the conclusion about the reasonableness of applied solutions and the existence of the risk of a lack of dissemination of sustainable forms of agriculture in the event of worse state support conditions.

Table II.4. Land and labour profitability of various forms of sustainable farming by type of farming

No.	Description	CF	ORG	AEF	NORF	SUST
Land profitability (PLN/ha)						
1	Specializing in field crops (type 1)	2 532	1 565	2 712	2 135	2 765
2	Specialized in horticultural crops (type 2)	10 228	-	-	-	-
3	Specialized in permanent crops (type 3)	4 729	2 347	2 803	-	-
4	Specialized in rearing grazing animals – grassfed animals (type 4)	2 753	1 602	2,487	2 744	2 813
5	Specializing in rearing granivores – granivorous animals (type 5)	4 554	-	4 404	5 320	-
6	Various crops (type 6)	2 868	2 591	2 068	3 281	2 651
7	Various animals (type 7)	2 354	2 385	2 501	2 399	2 488
8	Various crops and animals together (type 8)	2 245	1 870	2 474	2 160	2 641
Labour profitability (PLN/FWU)						
1	Specializing in field crops (type 1)	94 125	74 133	117 127	72 643	112 638
2	Specialized in horticultural crops (type 2)	48 886	-	-	-	-
3	Specialized in permanent crops (type 3)	52 480	63 737	69 385	-	-
4	Specialized in rearing grazing animals – grassfed animals (type 4)	46 388	30 690	47 805	49 659	51 399
5	Specializing in rearing granivores – granivorous animals (type 5)	91 409	-	105 851	132 993	-
6	Various crops (type 6)	34 703	27 693	36 913	25 784	62 569
7	Various animals (type 7)	31 613	26 734	40 753	29 856	33 979
8	Various crops and animals together (type 8)	40 949	35 715	52 675	47 400	57 280

CF – comparative farms; CER – cereal farms; ORG – organic farms; AEF – farms using agri--environmental programmes, NORF – Norfolk farms, SUST – sustainable farms.

Source: Prandecki et al. 2014, p. 105, 111-117.

Study results show that in relation to comparative farms, sustainable forms of agriculture are characterised by lower productivity. It is worth remembering that the study did not include the value of externalities. Its internalisation, would increase the number of effects included in the calculation of productivity, and probably change the relations between studied, different forms of agricultural holdings. Such change could ensure a long-term sustainability of agricultural production. The study indicates the need for a deeper approach to the processes of sustainable intensification (i.e. taking into account externalities) and the need to evaluate these processes not only in static terms, but also taking into account the dynamics of change.

The presented results confirm the existence of benefits from the specificity of production organisation and more efficient management (lower

costs and greater labour efficiency) of sustainable agricultural forms, which, combined with subsidies, leads to profitability approximately equal or even better than in comparative farms. This allows to state that the agricultural policy in terms of agri-environmental and sustainable farms is well founded. However, on the basis of the submitted study results, it cannot be determined whether it is optimal. Certainly, support for organic farming has to be increased, or even thoroughly reformed in terms of the principles of granting aid, because the currently applied policy does not compensate alternative costs, resulting in a decreasing interest in organic farms. In particular, this applies to organic farms undergoing transformation, when their production is lower, and without the benefit of higher prices for certified products. The effects, in the form of a decline in interest in this form of environment care, are already visible.

Study results also point to the need to diversify the volume of aid depending on the size of the farm. In the case of small holdings (up to 5 ha AL) current support is not sufficient to be an effective incentive, encouraging the use of ecological agricultural practices. This causes a small interest in the implementation of agri-environmental programmes by farmers owning small farms. This situation may also be caused by low profitability of incurred inputs in comparison with the expected results, organisational difficulties in applying for funding and the lack of knowledge and awareness. With the increase in farm area, the differences in individual production and economic results between comparative farms and different forms of sustainable agriculture are becoming smaller. This justifies the degressive nature of financial support for various forms of sustainable agriculture (while maintaining the differentiation between different forms of sustainability).

In general, it should be noted that the link between sustainability, productivity and profitability between various forms of agriculture is confirmed by the results of the studies carried out. On their basis it can be concluded that, in spite of lower productivity of sustainable forms of agriculture (in relation to comparative farms), higher organisational efficiency (lower labour inputs) and lower costs mean that the achieved individual income effects are relatively better.

Conclusions

Maintaining appropriate environmental conditions to ensure the sustainability of agriculture requires to convince farmers and policy makers to the merits of the actions taken. This implies the need for the implementation of solutions that are environmentally friendly, socially accepted and yielding appropriate benefits. In particular, it is relevant at the microeconomic level, i.e. that of a farm, because for such entities income is the primary criterion for

undertaking agricultural activity. For this reason, appropriate agricultural practices, conforming with the principles of sustainable development should be evaluated in the context of productivity and profitability. The justification of profitability of environmentally friendly activities should therefore be a priority for the economy of sustainability.

In practice, the predominant approach is the neo-classical attitude towards the economy and agriculture, which means, among others, minimising state interference in the market. The conviction about the reliability of the market causes that only those factors which have a monetary value are significant to farmers. Solutions that can lower income are treated as unacceptable, even if they lead to certain, important non-economic benefits.

The level of productivity and profitability could successfully convince about the legitimacy of the use of agricultural practices considered to be environmentally friendly and sustainable. The presented study results indicate that in the case of appropriate farm management, the use of sustainable agricultural practices may be comparable, and even more cost-effective, than in the case of traditional, industrial solutions. However, such differences in the level of results are not common (e.g. they occur only in specific area groups), which indicates the legitimacy of an active economic policy focused on maintaining or increasing the number of holdings and area of arable land used in an environmentally-desired way, in particular in the case of small farms. This is an essential prerequisite for the implementation of the principles of sustainable development.

The used test method has some frailties. The image of productivity and profitability presented in this manner is incomplete, because it does not take into account a number of externalities (costs and benefits) of relevance for agricultural production and for the society. The proper identification of such effects, their valuation and the inclusion in the production and economic calculation would significantly contribute to the correct valuation of socio--environmental values and thus – get closer to the social optimum.

In the context of externalities, one of the areas that require additional, in-depth analysis are environmental services. They are of fundamental importance for the sustainability of the development of agricultural production. Such an approach will allow for a more accurate description of the criteria for sustainability in agriculture. This is essential due to their importance for the proper conduct of production processes and recovering the production capacity of inputs. Lack of appropriate valuation methods and data underlying the consideration of such inputs in the analysis of productivity means that this calculation is incomplete.

The exclusion of externalities from the calculation of economic effects causes that the comparison of the productivity of sustainable and unsustainable forms of agriculture does not take into account relevant aspects of the sustainability of agriculture. However, the method used for the assessment of productivity and profitability of selected forms of sustainable agriculture provides information that facilitate decision-making in the framework of the State's economic policy, including various kinds of aids and subsidies. Their use allows the achievement of socially desirable goals. In the longer term, it is expected to create more advanced methods of assessing productivity and profitability which take account environmental and social aspects of sustainable development. For this reason, it is advisable to search for new ways to incorporate externalities into the economic calculation. At the same time, it should be noted that the construction of new analysis tools, such as for example, Total Social Factor Productivity (TSFP), will not quickly replace them with existing solutions, due to the inability to make international comparisons in the absence of commonly accepted research methodology. As a result, activities for the economic justification of sustainable approach to agriculture should be carried out in two ways, i.e.:

- through further assessment of productivity and profitability of farms using various practices (selected in terms of sustainability),
- at the same time expanding the catalogue of factors affecting productivity of the agricultural sector by positive and negative externalities.

Activities in the second area require, first and foremost, a precise definition of externalities, their identification in agriculture and classification in order to identify priorities for action. Only in the subsequent steps, attempts to internalise them should be made in order to calculate more accurate production and profitability indexes.

Chapter III

ECONOMIC FOOD AVAILABILITY AS ONE OF THE DIMENSIONS OF FOOD SECURITY IN POLAND

Introduction

Food security for centuries has meant an opportunity to provide food produced in whole or in majority in a given country in order to meet the needs of all of its inhabitants. With the growth of international trade and specialisation, food security perceived this way has changed. A rapid increase in world food production and free international trade has made it possible for countries with conditions unfavourable for the development of agricultural production to purchase the needed food on other markets. The access to food was decided by their income rather than domestic production. Income security has supplanted food security. Such perception of the issue was influenced by the economists who wished for food and agricultural products to be treated like other products and the volume and structure of domestic food production to be subject to market regulations and the principle of comparative costs. It was only the global food crisis at the turn of 2007 and 2008 that revived the discussion about food security in the global, regional, national and household dimension [Kwasek 2013]. The food crisis showed that a rapid rise in prices of basic goods causes that people with the lowest incomes, who spend a larger share of their budget for food, lose access to basic food products. Because of increased food prices in 2008, the number of undernourished people in the world, especially in countries dependent on food imports, increased by 75 million (in Asia and Pacific – by 41 million, in Sub-Saharan Africa – by 24 million, in Latin America and Caribbean – by 6 million and in the Near East and North Africa – by 4 million) whereas the number of people living in extreme poverty – by 125 million [Bello 2011].

Unstable food prices may be problematic not only for developing countries, but also for developed ones. Research conducted by Gunderson and Ziliak [2015] demonstrated that 15.5% of elderly people (9.6 million) in the United States of America in 2013 were deprived of food security in the economic dimension. This means that despite the end of the Great Recession in 2014, nearly 1 in 6 senior citizens is facing the threat of malnutrition. The majority of them have incomes above the poverty threshold.

1. Food security – the theoretical aspect

Food security is of fundamental importance to human existence. The first definition of food security, which covered only the physical aspect, was presented

at the World Food Summit in Rome in 1974. The 1980s saw the start of inclusion of not only the supply side of food security, but also the demand side, understood as ensuring economic access to food. It was recognised that physical access to food does not always go hand in hand with the possibility of its acquisition by all people.

The definition of food security has been evolving for the past forty years. In the literature, there are about two hundred definitions of food security [Hoddinott 1999; Simon 2012]. The many definitions and conceptual models all agree that the key defining characteristics of household food security is *secure access at all times to sufficient food*. We deal in turn with: (1) *sufficiency*, (2) *access*, (3) *security* and (4) *time* [Maxwell and Frankenberger 1992].

At the World Food Summit of the Food and Agriculture Organization of the United Nations (FAO) in 1996 it was assumed that *food security at the individual, household, national, regional and global levels will be achieved when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and preferences for an active and healthy life* [FAO 1996].

In recent years, most of the research initiatives for food security have focused on four key components of the FAO's definition:

1. *Availability*: providing a sufficient supply of food for all people at all times has historically been a major challenge. Although technical and scientific innovations have made important contributions focused on quantity and economies of scale, little attention has been paid to the sustainability of such practices.
2. *Accessibility*: the equality of access to food is a dimension of food security. Within and between societies, inequities have resulted in serious entitlement problems, reflecting class, gender, ethnic, racial, and age differentials, as well as national and regional gaps in development. Most measures to provide emergency food aid have attempted to help the disadvantaged but have had limited success in overcoming the structural conditions that perpetuate such inequities.
3. *Acceptability*: as essential ingredients in human health and well-being, food and food practices reflect the social and cultural diversity of humanity. Efforts to provide food without paying attention to the symbolic role of food in people's lives have failed to solve food-security problems. This dimension of food security is also important in determining whether information and food-system innovations will be accepted in a country, given the social and ecological concerns of its citizens.

4. *Adequacy*: food security also requires that adequate measures are in place at all levels of the food system to guarantee the sustainability of production, distribution, consumption, and waste management. A sustainable food system should help to satisfy basic human needs, without compromising the ability of future generations to meet their needs. It must therefore maintain ecological integrity and integrate conservation and development [Koc et al. 1999].

In 2009, at the next World Food Summit, this definition was updated with the word *social*, and it was assumed that food security should be understood as *a situation when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life* [FAO 2009]. This definition is the currently applicable definition of food security. Food security is generally characterized as having four dimensions:

1. *Availability*: the availability of sufficient quantities of appropriate quality.
2. *Access*: access by individuals to adequate resources for acquiring appropriate foods for a nutritious diet on a regular basis.
3. *Utilization*: utilization of food through adequate diet, clean water, sanitation and health care to reach a nutritional well-being where all physiological needs are met.
4. *Stability:* a population, household or individual must have access to food at all times and should not risk losing access as a consequence of sudden shocks or cyclical events [Bora et al. 2010, Simon 2012].

An original approach to the definition of food security was presented by Cook [2006], which believes that food security depends largely on the answers to five questions:

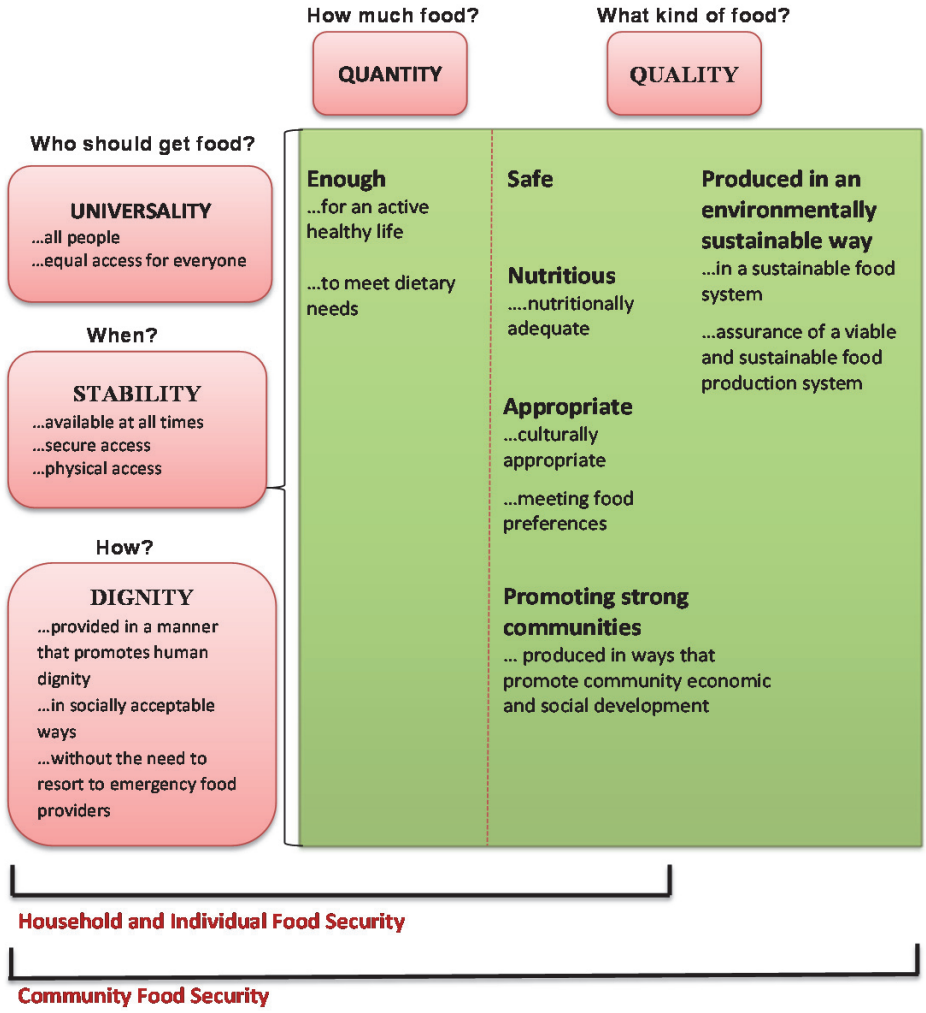
1. *Who should get the food?*
2. *When?*
3. *How?*
4. *How much food?*
5. *What kind of food?*

On the basis of these questions, it is possible to identify five key elements of the definition of food security:

1. *Universality*
2. *Stability*
3. *Dignity*
4. *Quantity*
5. *Quality*.

A graphic illustration of the questions, answers and identified elements of the definitions of food security is shown in Figure III.1.

Figure III.1. Common components of food security definitions



Source: Cook 2006, p. 22.

Food security can be seen at the global, national, household or individual levels. When analysing food security at the global level, one should consider the global production, food distribution, international trade, financial assistance, food aid, access to resources and revenues on the global scale [Alamgir and Arora 1991].

Food security at the national level involves ensuring the physical and economic availability of food in accordance with the Minimum Dietary Energy

Requirement (MDER) per capita during a given period and the requirements for creating state reserves. An important determinant is the volume of its food imports since dependence on it may in certain circumstances significantly deteriorate [Alamgir and Arora 1991; Weingärtner 2005a]. The determinants of achieving food security at the national level include: the resources and the availability of arable land, crop yields, environmental and climatic factors, as well as the administrative and socio-political environment [Alamgir and Arora 1991].

Food security at the individual level consists in ensuring physical and economic access to food adequate in terms of quality. It is measured e.g. by health and other indicators, which are directly influenced by the quantity and quality of food consumed. In the case of households, the determinant is the sufficient amount of food per family member to provide the minimum necessary consumption, which depends on the amount of income [Alamgir and Arora 1991]. The exact demand is determined on the basis of age, gender, type of work and the socio-professional situation. These determinants differ from region to region and depending on the climatic zone.

Food security is achievable only if economic and social security is ensured at the same time and domestic production is maintained at a level that ensures the food is available, foreign trade and food reserves are maintained and the processing and distribution function properly. Food security is primarily the result of all systemic and institutional solutions in the political, economic and social domains [Kwasek 2013].

Food security occupies more and more space in the debate on the future of the Common Agricultural Policy after 2013. It is evidenced by the European Parliament Resolution of 18 January 2011 on the recognition of agriculture as a strategic sector in the context of food security.

Ensuring food security in Poland is enshrined in the *Strategy for sustainable rural development, agriculture and fisheries for 2012-2020*, which has been developed by the Ministry of Agriculture and Rural Development. The main objective of the strategy is to improve the standard of living in rural areas and the effective use of their resources and potentials for sustainable development of the country, and one of the five specific objectives involves *Food security* (specific objective 3).

2. Economic food availability

Economic availability of food is ensured when all households and each unit from such a household has sufficient assets to purchase food in sufficient quantity and quality [Weingärtner 2005]. Such assets include:

1. Financial assets: cash, savings or liquid assets, such as jewellery;

2. Human assets: skills, knowledge, health;
3. Natural assets: natural resources, such as trees, land, clean air and water;
4. Physical assets: agricultural tools, infrastructure – roads, sanitation, water and energy supply systems – shelter, transportation equipment, household goods and utensils;
5. Social assets: trust, norms and values, which shape human interaction [WFP 2014]. The greater assets, the greater economic availability of food.

Economic availability of food means that the economically weakest households have access to the necessary food (thanks to various forms of food aid). In order for such food to be available in economic terms, the consumer must have the purchasing power that enables them to buy on the market the necessary amount of food understood as the sum of the caloric value and nutritive components for normal human life. The purchasing power of the consumer on the food market is determined by: income, food prices and prices of the other goods and services [Małysz 2008].

The absence of economic availability of food is equally determined by high and low prices. High prices affect the level of consumption and income of consumers, and therefore more resources have to be allocated for its purchase. On the other hand, low prices are a threat to the production and the income of producers. They mean the loss of revenue from sales and lower profits. These relationships gain a proper meaning when they are referred to specific entities at risk of food insecurity. Only in such a situation it is possible to determine how an increase or a decrease in food prices translates into its economic availability [Marzęda-Młynarska 2014].

Economic availability of food for all households is not an intrinsic feature of any economic and social system. In any economic and social system there are a certain percentage of low-income households, and it depends on the achieved level of socio-economic development of a given country, on the degree of income diversification and on non-economic reasons, such as illness, disability, advanced age, incomplete family, large family, alcoholism, drug addiction [Małysz 2008].

Economic availability of food at the national level, the level of households and the level of individuals is measured by many indicators. The indicators used by FAO include: the level of income, gross domestic product per capita, the Gini coefficient presenting income inequalities, total expenditures, expenditures on food, the proportion of food expenditures in the total expenditures, food prices. These indicators form the basis for the research to identify the problems in the area of economic availability of food, which includes: national macroeconomic and microeconomic analyses of food consumption, research on the expenditures

on food, assessment of the level of poverty and studies on the living standards of the population [Gerster-Bentaya 2005].

The macroeconomic data on food consumption (balance data sheet) show that Poland is a country with a relatively high nutrition level, which, in the light of the science of human nutrition, ensures a normal physical and psychological development of man. The balance data sheet, however, do not represent actual consumption concerning the supply of food (including natural consumption) available to an average citizen of the country.

The balance sheet data inform about the average annual food consumption (food supply) and do not include the differences in access to food. Even when the food supply on the national scale (physical availability of food) is sufficient for all people, it does not mean that individuals, groups of the population have access to food. Therefore, it is necessary to supplement the balance sheet information with the data from household budget surveys (HBS) developed by the Central Statistical Office (CSO)[1]. Household budget surveys are based on the representative method which allows for the generalisation of the results to the whole population of households within a margin of an error.

3. Income of households

The possibility of obtaining food products of appropriate quality and quantity by a household depends on the purchasing power, which is determined by income. Empirical studies on food consumption of households most often use the concept of available income. According to the definition adopted by the CSO, *available income is defined as a sum of household's current incomes from various sources reduced by prepayments on personal income tax made on behalf of a tax payer by tax-remitter (this is the case with income from hired work and social security benefits and other social benefits) by tax on income from property, taxes paid by self-employed persons, including those in free professions and individual farmers and by social security and health insurance premiums. The available income covers both income in cash and in kind, including natural consumption (consumer goods and services taken to satisfy household's needs from self-employment – in and outside farming) as well as*

[1] Central Statistical Office (CSO) provides statistics on the level and sources of income, expenditure and food consumption for the four socio-economic groups of households, i.e. employees, farmers, the self-employed, retirees and pensioners as a total for Poland and by place of residence: urban-rural. The classification into the urban or rural population group in Poland is decided by an administrative criterion. The urban population covers the people living in places that have official city rights and the rural population covers the people living outside the administrative borders of such cities [Frenkel 2003].

goods and services received free of charge. Available income is allocated to expenditures and savings increase[2] [CSO 2015a].

A study of household budgets shows that in 2014 an average monthly available income in the total households in Poland amounted to PLN 1,340.44 per capita (Table III.1). An available income higher than the average available income of total households in Poland has been reached by households of the self-employed (by 21.7%), households of retirees and pensioners (by 3.1%) and households of employees (by 0.6 %) whereas a lower available income was obtained by the households of farmers (by 21.6%).

Table III.1. Average monthly available income per capita in households in Poland by socio-economic groups and by place of residence in 2013-2014 – in PLN

HOUSEHOLDS	AVAILABLE INCOME					
	POLAND		URBAN		RURAL	
	2013	2014	2013	2014	2013	2014
Total	1,299.07	1,340.44	1,452.65	1,516.05	1,060.01	1,067.38
Employees	1,305.88	1,349.12	1,456.11	1,510.08	1,037.26	1,066.29
Farmers	1,156.13	1,050.85	-	-	1,169.54	1,033.95
Self-employed	1,581.05	1,631.64	1,764.57	1,819.23	1,247.77	1,290.33
Retirees and pensioners	1,328.65	1,382.32	1,480.66	1,541.52	1,046.34	1,089.87

Source: CSO 2014a, CSO 2015a.

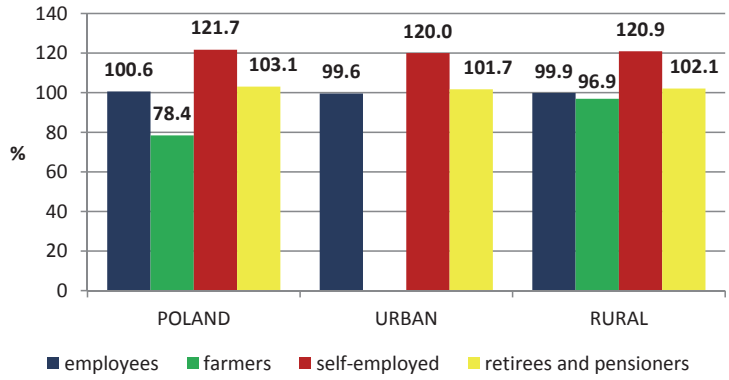
An analysis of available income depending on the place of residence revealed that inhabitants of urban areas obtain significantly higher income compared with the rural inhabitants (by 42%). An average monthly available income of households in total in rural areas in 2014 amounted to PLN 1,067.38 per capita and in urban areas it was PLN 1,516.05 per capita.

An available income higher than the average level in urban households was recorded in the households of the self-employed – by 20.0% (in rural – by 20.9%) and retirees and pensioners – by 1.7% (in rural – by 2.1%). The income in households of employees were slightly lower than the average, both in urban (by 0.4%) and in rural (by 0.1%) areas. The available income in households of farmers in rural areas amounted to PLN 1,033.95 per capita, which accounted for 96.9% of the average available income of households in total in rural areas.

[2] The available income comprises: (1) income from hired work, (2) income from a private farm in agriculture, (3) income from self-employment other than a private farm in agriculture, from profession, (4) income from property, (5) income from lease of a property or land, (6) social insurance benefits (of which retirement pensions and other pensions), (7) other social benefits, and (8) other income (including gifts and alimonies) [CSO 2015a].

The disparities in the average monthly available income of households in total in Poland and by the place of residence are shown in Figure III.2.

Figure III.2. The average monthly available income per capita dispersion in of households in total in Poland and the place of residence in 2014 (households in total = 100)



Source: developed on the basis of Table III.1.

In 2014, the household income per capita dispersion measured by the Gini coefficient[3] decreased in comparison to previous years and amounted to 0.326 (in 2011-2013 – 0.338). As it was in previous years income of farmers' was the most dispersed (0.544) and retirees the least (0.236). Income in rural areas is more diverse (0.329) than in urban ones (0.306) [CSO 2015a].

The average monthly available income of households in total in Poland in 2013-2014 grew in real terms by 3.2%, in households of retirees and pensioners – by 4.0%, in households of employees – by 3.3%, in households of the self--employed – by 3.2%, and it decreased in households of farmers by 8.7%.

The income situation in 2013-2014 has improved in all groups of socio--economic groups of households by the place of residence, with the exception of farmer's households in rural areas, where there was a decline in real income – by 11.2%. The largest increase in disposable income in real terms in urban areas was recorded in households of retirees and pensioners – by 4.1% (in rural households – by 4.2%), followed by households of the self-employed – by 3.1% (in rural households – by 3.4%) and households of employees – by 3.7% (in rural households – by 2.8%).

[3] Gini coefficient – indicator of income concentration. It receives values between 0 and 1 (or if multiplied by 100 – between "0" and "100"). The indicator is equal to "0" if all persons have the same income and equal to "1" if all persons except one have zero income. The larger is value of the indicator, the larger are income inequalities [CSO 2015a, p. 36].

4. Consumer expenditures of households

The income situation of households directly determines the level and structure of consumer expenditures and determines the degree of satisfaction of material and non-material needs.

Expenditures comprise expenditures on consumer goods and services[4] and other expenditures. According to the definition adopted by the CSO, *expenditures on consumer goods and services are allocated to satisfying household's needs. They include products purchased by cash, also using debit or credit card, on credit, received free of charge and natural consumption (consumer goods and services taken from individual farm or own economic activity to satisfy household's needs)*[5].

In 2014, a Polish family spent on their needs on average PLN 1,078.74 per capita a month. A family in urban areas spent PLN 1,210.50 per capita to satisfy their needs, i.e. 38.5% more than a family in rural areas (PLN 873.85). Among the households located in urban areas, the lowest level of total expenditure was characterized by households of employees – PLN 1,178.68 per capita and the highest was for the households of the self-employed – PLN 1,431.76 per capita. Among the households located in rural areas, the lowest level of total expenditure was in the households of farmers – PLN 792.91 per capita, and the highest was for the households of the self-employed – PLN 1,067.04 per capita (Table III.2). The spread between the highest and the lowest level in total expenditures in urban areas amounted to PLN 253 per capita per month (in rural areas – PLN 274).

Households generally do not spend all obtained income on consumption. A comparison of income and consumption expenditures of households in 2014 shows that current incomes of families living in urban and rural areas were enough to cover their expenditures. Households of farmers allocated 23.3% of their income to savings, for households of employees it was 19.4% (in urban areas – 21.9%), for households of the self-employed – 17.3% (urban – 21.3%) and for households of retirees and pensioners – 13.4% (urban – 17.4%).

When assessing the food security of households, according to FAO recommendations, one should take into account the percentage of food expenditures in the total expenditures, as determined on the basis of results of

[4] Classification of expenditures on consumer goods and services is based on COICOP/HBS (*Classification of Individual Consumption by Purpose for Household Budget Surveys*).

[5] Consumer goods comprise non-durable goods (e.g. food, beverages or medicines), semi--durable goods (e.g. clothes, books, toys) and durable goods (e.g. cars, washing machines, refrigerators, television sets) [CSO 2015a].

household budget surveys. According to the size of the indicator, you can determine the level of material well-being, i.e. the prosperity of a given household, a specific population of households and even the whole society. This relationship is – according to the laws of Engel – inversely proportional, so it means that the lower the proportion of expenditure on food in the total consumption expenditures, the higher the level of well-being of the population in question, and vice versa [Bywalec 2000]. The poorer the household, the greater the share of expenditures on food.

Table III.2. Average monthly consumer expenditures in households by socio-economic groups in Poland and the place of residence in 2013-2014

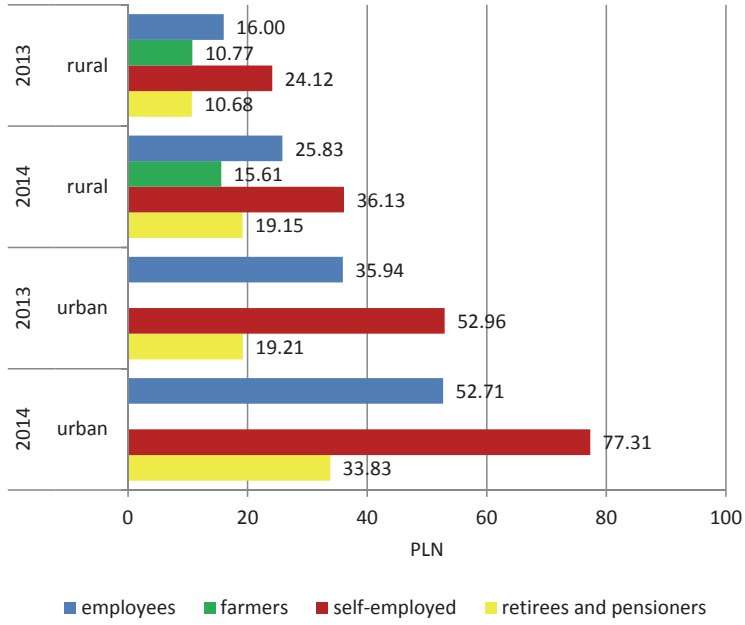
HOUSEHOLDS	POLAND		URBAN		RURAL	
	2013	2014	2013	2014	2013	2014
	Expenditures (in PLN per capita)					
Total	1,061.70	1,078.74	1,182.98	1,210.50	872.93	873.85
Employees	1,050.32	1,062.96	1,156.99	1,178.68	859.61	859.62
Farmers	784.62	799.35	-	-	779.99	792.91
Self-employed	1,288.31	1,302.40	1,393.99	1,431.76	1,096.41	1,067.04
Retirees and pensioners	1,144.22	1,156.86	1,250.77	1,272.77	946.36	943.93
	Expenditures on food and non-alcoholic beverages (in PLN per capita)					
Total	264.36	263.34	275.27	276.06	247.38	243.55
Employees	248.81	246.80	258.28	258.04	231.87	227.04
Farmers	246.99	247.73	-	-	247.06	247.93
Self-employed	273.40	271.70	285.17	282.70	252.04	251.69
Retirees and pensioners	314.88	314.54	327.42	329.79	291.59	286.53
	Share of expenditures on food and non-alcoholic beverages in the total expenditures (percentage)					
Total	24.9	24.4	23.3	22.8	28.3	27.9
Employees	23.7	23.2	22.3	21.9	27.0	26.4
Farmers	31.5	31.0	-	-	31.7	31.3
Self-employed	21.2	20.9	20.5	19.7	23.0	23.6
Retirees and pensioners	27.5	27.2	26.2	25.9	30.8	30.4
	Share of expenditures on catering in the expenditures on food and non-alcoholic beverages (percentage)					
Total	9.9	15.4	12.2	18.6	6.0	9.8
Employees	11.6	17.4	13.9	20.4	6.9	11.4
Farmers	4.8	6.6	-	-	4.4	6.3
Self-employed	15.6	23.1	18.6	27.3	9.6	14.4
Retirees and pensioners	5.2	9.1	5.9	10.3	3.7	6.7

Source: developed on the basis of unpublished CSO data.

In 2014, a Polish family spent on the purchase of food and non-alcoholic beverages PLN 263.34 per capita per month, which represented 24.4% of total expenditures. Among the households located in urban areas, the lowest percentage of expenditures on food and non-alcoholic beverages was in households of the self-employed (19.7%) and the highest in households of retirees and pensioners (25.9%). Among the households located in rural areas, the lowest percentage of expenditures on food and non-alcoholic beverages was in households of the self--employed (23.6%) and the highest in households of farmers (31.3%).

In order to determine the actual expenditures on food and non-alcoholic beverages, the total expenditures have to include the expenditures on catering services[6]. Average monthly expenditures on catering services in households in total in Poland and place of residence in 2014 are shown in Figure III.3.

Figure III.3. Average monthly expenditures on catering services in households in total in Poland and in urban and rural areas in 2013 – in PLN per capita



Source: developed on the basis of unpublished CSO data.

[6] Catering services provided by: restaurants, cafes, tearooms, bars and in places providing recreational, cultural and sporting services, included are cooked dishes to take away, products dispensed ready for consumption by automatic vending machines (sandwiches, snack bars, coffee), tips, catering services of works canteens, office canteens and canteens in schools, universities [CSO 2015a].

The place of residence is an important factor differentiating expenditures on catering. In the years 2013-2014 expenditures on catering in Poland increased in nominal and real terms by 54.9% (in urban areas – by 53.2%, and in rural – 60.7%). The growth rate of expenditures on catering in the rural areas was higher than in urban ones, but the level of expenditures – lower by 53.7%.

Increased expenditures on catering demonstrate the increased interest in this form of meeting needs in terms of food, especially among the inhabitants of urban areas. New eating habits of having meals outside home have been popular especially among young people who live in a constant hurry, spend most of their time at work or trying to reconcile learning and working. They do not have enough time to prepare traditional meals at home because they want to eat a fast, cheap and tasty meal. All of this can be found e.g. in restaurants serving fast food.

In 2014, the share of expenditures on catering in the expenditures on food and non-alcoholic beverages in households in total in Poland was 15.4% (in urban households – 18.6% and in rural ones – 9.8%). In comparison with the previous year, an increase was recorded in the share of expenditures on food and non-alcoholic beverages in catering services in all groups of the population in question: in households of self-employed (in urban by 8.7 pp and in rural by 4.8 pp), in households of employees (in urban by 6.5 pp and in rural by 4.5 pp), in households of retirees and pensioners (in urban by 4.4 pp and in rural by 3.0 pp) and in households of farmers in rural areas (by 1.9 pp).

When analysing the expenditures on food outside home in various socio--economic groups of households by the place of residence, it was found that:

- the self-employed spent most on catering services, which is closely linked to the level of income generated by these households (however the expenditures in urban areas was 2.1 times higher than in rural ones);
- retirees and pensioners least often use the services of eateries because their expenditures on catering services are the lowest in urban areas and one of the lowest in rural ones;
- in the households of farmers, despite the deterioration in the income situation in 2014, the expenditures on catering services in comparison with 2013 increased – from PLN 10.77 per capita to PLN 15.61, i.e. by 44.9%; this indicates changing trends in the diet;
- employees living in urban areas spent on catering 2 times more than employees in rural ones.

On average, a household in urban areas in 2014 spent 27.1% of total expenditures on food and non-alcoholic beverages (including expenditures on catering services) whereas a household in rural ones – 30.6%. In individual socio-economic groups of households in urban areas, this share was as follows:

25.1% in households of the self-employed (in rural areas – 27.0%), 26.4% – in households of employees (in rural areas – 29.4%), 28.6% – in households of retirees and pensioners (in rural areas – 32.4%). This share in households of farmers in rural areas amounted to 33.2%.

5. Food consumption in households

There are large differences in the level and structure of consumption of basic foodstuffs between individual socio-economic groups of households[7].

Assuming the total monthly consumption of basic foodstuff groups per capita as a quantitative measure of diversity, it was found that the average monthly food consumption in households in Poland in 2014 was 33.64 kg per capita. Most food was consumed in households of retirees and pensioners – 42.94 kg, and the least in households of the self-employed – 29.67 kg. The difference between the highest and the lowest level of food consumption amounted to nearly 13 kg per capita a month. Food consumption in households of farmers equalled 38.87 kg, and in households of employees it was 30.22 kg.

An analysis of food consumption in households by socio-economic groups showed that households of retirees and pensioners consumed most of pasta, pasta and products, rice, bakery products, beef, poultry, processed meat and other meat preparations of which poultry processed meat, fish and seafood, fresh low-fat milk, curd, butter and the other animal fats, margarine and other vegetable fats, vegetable oils, fruit (apples, citrus fruit, dried fruit, nuts), vegetables and confectionery (Table III.3).

The retirees and pensioners consume a relatively big share of products from their own farm –16.2% of vegetables, 15.2% of potatoes, 14.4% of eggs, 8.1% of fruit and 4.6% of fresh milk (Table III.4). High levels of consumption in households of retirees and pensioners result also from the structure of population in households. In households of retirees and pensioners there are mainly adults, whose needs in terms of quantity of consumed food are greater than in households with a high proportion of children. Children under 14 accounted for 3.4% of the total number of people in households of retirees and pensioners, in the case of farmers – 17.3%, employees – 20.0% and in the households of the self-employed – 22.5% [CSO 2015a, p. 90].

[7] The consumption of foodstuffs in households covers the products purchased for cash, also using debit or credit card, on credit, received free of charge and taken from the private farm in agriculture or own business activity (natural consumption). The moment of consumption of foodstuffs is defined as the moment of gaining them by the household. The data on quantitative consumption does not cover food consumed in catering services (canteens at workplaces, bars, restaurants, etc.) [CSO 2015a, p. 35].

Table III.3. Average monthly consumption of basic foodstuffs in households in Poland by socio-economic groups in 2014 – in kilograms per capita

Specification	Households of				
	total	employees	farmer	self--employed	retirees and pensioners
Bread and cereals	6.26	5.73	7.53	5.28	7.67
bread	3.94	3.63	4.99	3.16	4.70
pasta and pasta products	0.37	0.34	0.36	0.34	0.44
rice	0.17	0.16	0.14	0.17	0.22
bakery products	0.76	0.71	0.60	0.72	0.96
Meat	5.29	4.79	6.03	4.57	6.75
pork	1.31	1.17	1.90	1.16	1.65
beef	0.09	0.07	0.06	0.11	0.13
poultry	1.53	1.38	1.64	1.32	1.99
processed meat and other meat preparations	2.03	1.90	2.07	1.74	2.49
poultry processed meat	0.19	0.18	0.16	0.16	0.21
Fish and seafood	0.33	0.28	0.31	0.34	0.46
Milk	5.06	4.60	5.96	4.77	6.08
fresh whole milk	2.05	1.78	3.92	1.74	2.39
fresh low-fat milk	1.30	1.22	0.67	1.29	1.68
yogurt	0.50	0.51	0.34	0.55	0.51
curd	0.43	0.38	0.36	0.43	0.59
ripening and melted cheese	0.39	0.40	0.28	0.42	0.38
Eggs	0.60	0.53	0.73	0.51	0.77
Oils and fats	1.21	1.08	1.31	0.97	1.60
butter	0.25	0.22	0.22	0.27	0.36
other animal fats	0.08	0.06	0.11	0.05	0.14
margarine and other vegetable fats	0.42	0.39	0.50	0.27	0.52
vegetable oils	0.45	0.41	0.48	0.39	0.58
Fruit	3.59	3.25	3.11	3.72	4.72
apple	1.17	1.00	1.24	1.05	1.67
citrus fruit	0.64	0.58	0.43	0.67	0.85
bananas	0.48	0.49	0.32	0.55	0.51
dried fruit and nuts	0.09	0.08	0.05	0.11	0.11
processed fruit	0.05	0.05	0.04	0.06	0.05
Vegetables	4.91	4.34	5.28	4.59	6.53
processed vegetables	0.66	0.62	0.50	0.66	0.83
Potatoes	3.92	3.37	5.60	2.79	5.25
Processed potatoes	0.10	0.11	0.05	0.10	0.09
Chips	0.06	0.07	0.05	0.06	0.04
Sugar, jam, honey, confectionary	1.89	1.70	2.42	1.62	2.38
sugar	1.19	1.01	1.79	0.89	1.59
confectionary	0.23	0.23	0.19	0.23	0.24
ice-cream	0.22	0.23	0.25	0.21	0.21
Coffee, tea and cocoa	0.24	0.22	0.22	0.21	0.32
Mineral and spring waters (l)	4.17	4.19	3.15	4.89	4.30
Non-alcoholic beverages (l)	3.40	3.67	3.64	3.40	2.69
Juice (l)	0.88	0.96	0.58	1.18	0.70

Source: developed on the basis of unpublished CSO data.

The highest consumption of bread, pork, fresh whole milk, potatoes and sugar, and the lowest consumption of rice, bakery products, beef, poultry processed meat, fresh low-fat milk, yogurt, curd, ripening and melted cheese, butter, citrus fruit, bananas, dried fruit and nuts, processed fruit, processed vegetables, processed potatoes, confectionery, mineral and spring waters, juices (fruit, vegetable and fruit-vegetables) was found in households of farmers, so these were highly processed products. A high consumption of potatoes, milk fresh, eggs, pork, vegetables, poultry, curd and fruit in households of farmers is a result of a large share of the consumption of food obtained from their own farms.

Table III.4. Consumption of food products obtained from farm in 2014 – as a percentage of total food consumption

Specification	Households of				
	total	employees	farmer	self--employed	retirees and pensioners
Meat	4.9	2.8	35.2	2.5	2.5
Pork	7.6	3.4	52.6	3.4	3.0
Beef	-	-	50.0	-	-
Poultry	6.5	4.3	40.9	3.0	4.5
Processed meat and other meat preparations	1.5	1.1	15.0	1.1	0.8
Milk fresh	8.9	4.5	60.5	2.7	4.6
Curd	4.7	2.6	28.9	2.3	3.4
Eggs	17.6	13.3	76.3	7.7	14.4
Butter	-	-	13.6	-	-
Fruit	8.6	7.1	37.0	4.8	8.1
Vegetables	14.5	11.5	52.1	7.0	16.2
Potatoes	20.7	16.3	77.5	11.5	15.2

Source: own calculations based on unpublished CSO data.

With the socio-economic development of the country and improvement of the population's income situation, as well as the enrichment of the market in a wide assortment of food products, the importance of natural consumption in households decreases significantly [Kwasek 2012]. The essence of changes in the structure of food consumption, especially in households of farmers, lies in the transition from self-supply of food to increased purchases thereof on the market. This process covers not only quantitative changes, but also qualitative ones, which result from changes in the product assortment and increased share of industrial processing in market purchases [Gulbicka and Kwasek 2007].

A characteristic feature of the pattern of food consumption in households of the self-employed is a relatively high consumption of more expensive food

products, i.e. fish and seafood, yoghurt, ripening and melted cheese, bakery products, processed potatoes, chips, mineral and spring waters, juices (fruit, vegetable and fruit-vegetables), as well as citrus fruit and bananas and beef and a low consumption of bread, pasta and pasta products, poultry, processed meat and other processed meat products of which poultry processed meat, animal fats (no butter), margarine and other vegetable fats, potatoes and sugar.

The households of the self-employed buy high-quality food, which is evidenced by the cost incurred by them for the purchase of one kilogram of food. In 2014, it amounted to PLN 6.94 and was higher by 29.5% than in households of farmers, where the lowest cost (PLN 5.36) was reported. The average monthly expenditures per kilogram of food in households of employees amounted to PLN 6.32, and in households of retirees and pensioners it was PLN 6.21.

The consumption of most food products in households of employees is much lower than the national average, with the exception of yogurt, ripening and melted cheese, bananas, processed potatoes, chips, ice-cream, non-alcoholic beverages, mineral and spring waters and juices (fruit, vegetable and fruit--vegetables). This means that the households of employees also consumed more food with a higher degree of processing and higher quality.

An analysis of the average daily food consumption per capita in terms of their caloric value and nutritive components in households by socio-economic groups showed that the most energy and nutrients were supplied by food consumption in households of retirees and pensioners – 2,481 kcal, followed by households of farmers – 2,245 kcal, households of the self-employed – 2,087 kcal and the households of employees – 2,061 kcal (Table III.5).

The quality of food is determined by the amount of protein in the average daily food consumption. Total protein intake in Poland amounted to 71 grams per capita a day. Animal protein intake ranged from 44 g in households of employees to 53 g in households of retirees and pensioners. From the point of view of nutritional physiology, the best use of animal proteins in the human body occurs when the ratio of vegetable protein to animal protein is 1:1. The intake of animal protein in households of farmers accounted for 62.5% of the total protein intake, in households of retirees and pensioners it was 64.6%, in households of employees – 64.7% and in households of the self--employed – 65.7%.

According to nutritional recommendations of international organisations dealing with issues concerning the nutrition of the population and also by the Food and Agriculture Organisation of the United Nations (FAO), World Health Organization (WHO) and the Polish experts in the science of human nutrition,

the share of energy derived from protein intake in the energy value of the daily food intake should be 10-15%, for fat 25-35% and for carbohydrates 50-70%, including refined sugar below 10% [Jarosz et al. 2012].

Table III.5. Average daily consumption calculated into caloric value and nutritive components per capita in households by socio-economic groups in Poland in 2013[a]

Specification	Households of				
	total	employees	farmers	self--employed	retirees and pensioners
Caloric value (kcal)	2,187	2,061	2,245	2,087	2,481
Nutritive components (g)					
Protein	71	68	72	70	82
animal protein	46	44	45	46	53
vegetable protein	25	24	27	24	29
Fats	90	84	88	85	104
Carbohydrates	259	244	278	242	290

[a] gross, i.e. including losses due to storage, meal preparations, usable residuals etc.; excluding alcoholic beverages; including estimated consumption in catering services; caloric value and nutritive components have been computed in accordance with values estimated by the National Food and Nutrition Institute

Source: developed on the basis of [CSO 2014b].

An analysis of food consumption in households by socio-economic groups showed that food intake in 2014 in all groups of the population was not in line with nutritional recommendations. The share of energy derived from fat intake in the caloric value of daily food consumption was significantly higher than the recommended level and ranged from 35.3% in households of farmers to 37.7% in households of retirees and pensioners (the total in Poland – 37.0%).

The share of energy derived from sugar consumption in the caloric value of the daily food consumption in the supplied energy was in line with nutritional recommendations for all households, except farmers' (10.5%), and ranged from 5.6% in households of the self-employed to 8.4% in households of retirees and pensioners (total in Poland – 7.1%).

The share of energy derived from protein intake in the caloric value of daily food consumption was in line with nutritional recommendations, but it has not reached the upper limit of 15% in any group of the population. The highest share of energy from protein intake was recorded in the households of the self--employed – 13.4%, and the lowest in the households of farmers – 12,8%, and in the households of employees and households of retirees and pensioners – 13.2% (total in Poland – 13.0%).

The consumption of milk and processed milk products, fruit, vegetable, fish and seafood in all socio-economic groups of the population in Poland is too small in relation to dietary recommendations. Shortage in consumption of:

- milk and processed milk products – it ranged from 62.3% in households of retirees and pensioners to 71,5% in households of employees;
- fruit and vegetables – it ranged from 21.4% in households of retirees and pensioners to 43.8% in households of employees;
- fish and seafood – it ranged from 42.5% in households of retirees and pensioners to 65.0% in households of employees.

From the point of rationalization of consumption the structure of consumed meat is important. The consumption of poultry constitutes the biggest share in the households of employees, the self-employed as well as retirees and pensioners, whereas in the case of farmers – the consumption of pork (Table III.6).

Table III.6. Structure of consumed meat, offal and meat preparations in households in 2014 – as a percentage (consumption of meat, offal and preparations = 100)

Specification	Households of				
	total	employees	farmers	self--employed	retirees and pensioners
Meat, offal and preparations	100.0	100.0	100.0	100.0	100.0
raw meat	56.7	56.2	60.7	58.4	57.0
pork	24.8	24.4	31.5	25.4	24.4
beef and veal	1.9	1.7	1.2	2.8	1.9
poultry	28.9	28.8	27.2	28.9	29.5
other meat	1.1	1.3	0.8	1.3	1.2
processed meat and other meat preparations	38.6	39.7	34.3	38.1	36.9
processed meat except for poultry	30.3	31.1	28.8	30.2	28.9
poultry processed meat	3.6	3.8	2.7	3.5	3.1
other meat preparations	4.7	4.8	2.8	4.4	4.9
offal and offal preparations	4.7	4.1	5.0	3.5	6.1

Source: own calculations on the basis of unpublished CSO data.

A high proportion of the consumption of processed meat and other meat preparations was reported in all socio-economic groups of the population – ranging from 34.3% in households of farmers to 39.7% in households of employees. Meat preparations include mainly pork and beef, whereas poultry meat preparations represent a small part thereof. The share of poultry processed meat in the structure of consumed processed meat in the households of farmers amounts to 2.7%, in the households of retirees and pensioners it is 3.1%, in the households of the self-employed it is 3.5% and in the households of employees

– 3.8%. This means that consumption of red meat is much higher than it results from the presented structure of consumption of raw meat.

According to nutritional recommendations, changes should be made in the structure of the consumed meat, namely red meat should be partly replaced by lean poultry meat (without the skin) and fish.

An analysis of food intake depending on the place of residence showed that in 2014 both in urban and rural areas, the consumption of fruit, vegetables, milk and processed milk products, fish and seafood with a significant impact on human health was too small in relation to the nutritional guidelines recommended by FAO, WHO and Polish experts in the science of human nutrition (Table III.7).

Table III.7. Consumption of fruit, vegetables, fish and milk and processed products relative to the nutritional recommendations in households in Poland by socio-economic groups and place of residence in 2014 – per capita

Specification	Households of									
	total		employees		farmers		self--employed		retirees and pensioners	
	urban	rural	urban	rural	urban	rural	urban	rural	urban	rural
Fruit and vegetables [a]										
nutritional recommendation	**500-800 grams per capita a day**									
intake (g/day)	**324**	**285**	**292**	**261**	**-**	**294**	**325**	**288**	**419**	**346**
deficiency (%)					-					
lower limit	35.2	43.0	41.6	47.8	-	41.2	35.0	42.4	16.2	30.8
upper limit	59.5	64.4	63.5	67.4	-	63.3	59.4	64.0	47.6	56.8
Fish and seafood										
nutritional recommendation	**200 g per capita a week**									
intake (g/week)	**81**	**69**	**67**	**62**	**-**	**72**	**81**	**72**	**115**	**88**
deficiency (%)	59.5	65.5	66.5	69.0	-	64.0	59.5	64.0	42.5	56.0
Milk and processed milk products										
nutritional recommendation	**530-600 grams per capita a day**									
intake (g/day)	**163**	**171**	**151**	**153**	**-**	**197**	**154**	**161**	**197**	**207**
deficiency (%)					-					
lower limit	69.2	67.7	71.5	71.1	-	62.8	70.9	69.6	62.8	60.9
upper limit	72.8	71.5	74.8	74.5	-	67.2	74.3	73.2	67.2	65.5

[a] including fruit juices, vegetable juices and fruit-vegetable juices

Source: developed on the basis of unpublished CSO data.

The level of consumption of fruit and vegetables (including fruit juices, vegetables juices, fruit-vegetables juices) in households located in urban areas in 2014 amounted to 324 grams per capita a day, which means that the deficiency in the intake thereof compared to the minimum recommended level (500 g per capita a day) amounted to 35.2% and, compared to the maximum level (800

grams per capita a day) – 59.5%. Among the socio-economic groups of households in question, the lowest level of consumption thereof in urban areas was observed in households of employees – 292 g per capita a day, and the highest in households of retirees and pensioners – 419 g.

Employees in urban areas consumed 3 portions of fruit and vegetables a day instead of the recommended 5 portions, the self-employed – 3.3 portion, and retirees and pensioners – 4.2 portion. This means that the deficiency in fruit and vegetable consumption in relation to the minimum recommended level ranged from 16.2% in the households of retirees and pensioners to 41.6% in the households of employees and in relation to the maximum level it ranged from 47.6% in the households of retirees and pensioners to 63.5% in the households of employees.

The level of fruit and vegetable consumption in households located in rural areas was even lower than in households in urban areas. Among the socio--economic groups of households in question, the lowest level of consumption of fruit and vegetables in rural areas was observed in the households of employees – 261 g per capita a day, and the highest in the households of retirees and pensioners – 346 g. The farmers consumed 294 g of fruit and vegetables a day, and the self-employed – 288 g. The deficiency in fruit and vegetable consumption in relation to the minimum recommended level ranged from 30.8% in the households of retirees and pensioners to 47.8% in the households of employees.

The factor that is of major importance in shaping the intake of fruit and vegetables is available income. As the income increases, the consumption thereof increases as well. The poorest people in Poland consume only 211 grams of fruit and vegetables (including fruit, vegetables, fruit-vegetables juices) a day, which represents 57.8% of the lower limit of the recommended standards and 73.6% of the upper limit. The wealthiest people consume 438 g of fruit and vegetables, which is two times more than the poorest people, but still too little in relation to nutritional recommendations.

The level of consumption of fish and seafood in households located in urban areas amounted to 81 g per capita a week (in rural – 69 g), which means that the deficiency of dietary intake thereof relative to the recommended level amounted to 59.5% (in rural – 65.5%). Among the population groups in question, the lowest level of consumption of fish and seafood was observed in the households of employees – 67 g per capita a week (in rural – 62 g), while the highest was in the households of retirees and pensioners – 115 g (in rural – 88 g). The deficiency in the consumption of fish and seafood in relation to a healthy pattern ranged from 42.5% in the households of retirees and pensioners (in urban areas) to 69.0% in the households of employees (in rural areas).

An analysis of fish and seafood consumption in households depending on the obtained income showed that the poorest people consumed only 53 g per capita a week, and the wealthiest people – 120 g. The deficiency in the poorest households in the consumption of fish and seafood amounted to 73.5%, whereas in the wealthiest households it was 40.0%.

For health reasons, fish and seafood should be consumed in much larger quantities than currently. Unfortunately, the price is a barrier that limits the demand for fish and seafood, whose range on the market is very diverse. One kilogram of frozen fillets of hake in 2014 cost PLN 21.76, which is three times more than for one kilogram of disembowelled chickens (PLN 7.34).

The consumption of fish and seafood will increase only when the income of the population in Poland increases. Research on the interdependence between the income and consumption of food indicates that income growth by 1% may increase the demand for fish and seafood by 1.239% in the poorest households and only by 0.194% in the households of the wealthiest people. Consumption of fish and seafood will increase faster in the households of the wealthiest people, who, in addition to sufficient funds to buy them, attach great importance to a proper lifestyle, including proper nutrition.

Consumption of milk and processed milk products in sufficient quantities satisfies almost 100% of the body's demand for calcium and vitamin B_2 and 60% of the demand for protein. According to current nutritional recommendations on the consumption of milk and processed milk products, everyone should drink two glasses of milk daily or the same amount of yogurt or kefir and eat one or two slices of cheese [Kozłowska-Wojciechowska 2007].

The average consumption of milk and processed milk products in Poland in 2014 amounted to 166 g per capita a day. This means that an average Pole does not drink even one glass of milk a day. Inhabitants of urban areas consumed only 163 g of milk and processed milk products per capita a day, which means that the deficiency in the consumption thereof in relation to the minimum recommended level (530 g per capita a day) amounted to approximately 69.2%, and in relation to the maximum (600 g per capita a day) – it was 72.8%. Among the population groups in urban areas, the lowest level of consumption of milk and processed milk products was recorded in the households of employees – 151 g per capita a day, and the highest in the households of retirees and pensioners – 197 g. Given only the lower level of the recommended consumption of milk and processed milk products, the deficiency in relation to the healthy pattern amounted to 62.8% in the households of retirees and pensioners, 74.3% in the households of the self--employed and 74.8% in the households of employees.

The level of consumption of milk and processed milk products in households located in rural areas was only slightly higher than in urban areas. Given only the lower level of the recommended consumption of milk and processed milk products, this deficiency, compared to the healthy pattern, amounted to 67,7%. Among the socio-economic groups of households in rural areas, the lowest level of consumption of these products was recorded in households of employees (153 g per capita a day), and the highest in households of retirees and pensioners (207 g), in the households of the self-employed (161 g) and the households of farmers – 197 g.

An analysis of the consumption of milk and processed milk products in households by the income groups showed that the households of 20% of the poorest people in Poland consume only 143 g of milk and processed milk products per capita a day, whereas the households of 20% of the wealthiest people consume 189 g per capita day, i.e. about 32.2% more than in the poorest households, but still much below the recommended values.

With such low levels of consumption of milk and processed milk products in Poland, serious health consequences for the inhabitants, including children and adolescents, have to be expected. A study by the National Institute of Child Health and Human Development shows that osteoporosis is not only a disease of the elderly, but also a disease of childhood, and it also involves geriatric complications. The osteoporosis in adulthood is a consequence of inadequate bone mineralisation in the first two decades of life [Nieradko-Iwanicka and Borzęcki 2014].

The level of consumption of milk and processed milk products both in urban and rural areas is much lower than the nutritional recommendations, although there is a wide range of dairy products with good taste available on the market. A problem for many households results primarily from high prices of milk and processed milk products and insufficient information about the beneficial effects of milk and processed milk products on human health, mainly fermented milk drinks, i.e. yogurt and kefir.

Suppose a person tolerating milk drank two glass of milk and ate two slices of cheese a day (for example, 20 g of ripening cheese and 40 g of semi-skimmed curd). The total expenditures for these products in 2014 amounted to PLN 2.48 per capita, which gives PLN 75.39 a month. After replacing two glasses of milk with two glasses of yogurt, the cost increases to PLN 157.47 a month, or more than twofold.

For households with the lowest level of available income in Poland, among the groups of people earning a living on the basis of employment, i.e. households of employees located in rural areas, the expenditure incurred on the

purchase of two glasses of yogurt, 20 g of ripening cheese and 40 g of curd would represent 69.4% of the total expenditures on food and non-alcoholic beverages. Other products such as bread, cereals, fruit, vegetables, meat and fish are also needed for proper human development. Only approximately PLN 70 would be left to the employees for the purchase of these products.

For households of 20% of the poorest people in Poland, the expenditures on the above-mentioned dairy products represent 84.8% of the total expenditures on food and non-alcoholic beverages. Only PLN 28.14 per capita a month is left for the purchase of fruit, vegetables, meat and fish. This means that at least 20% of Polish citizens, i.e. over 7.7 million people, cannot afford a diet in line with nutritional recommendations.

Table III.8 shows the average monthly expenditures on foodstuffs that have a beneficial impact on human health in households in Poland by socio--economic groups and place of residence in 2014.

Table III.8. Average monthly expenditures on foodstuffs that have a beneficial impact on human health in households by socio-economic groups in urban and rural areas in 2014 – in PLN per capita

Expenditures	Households of						
	employees		farmers	self-employed		retirees and pensioners	
	urban	rural	rural	urban	rural	urban	rural
Food [a]	230.78	210.88	235.30	256.93	236.39	291.96	267.21
Milk and processed milk products	28.81	24.31	25.55	32.56	27.07	33.57	30.05
fresh whole milk	2.87	4.45	8.05	3.15	4.39	4.00	6.86
yogurt	3.77	2.63	0.96	4.31	3.41	3.84	2.25
curd	5.68	4.52	5.12	6.45	5.06	7.99	6.47
ripening, melted cheese	7.67	5.24	4.35	8.80	6.19	7.12	5.00
Fish and seafood	7.01	5.74	5.97	8.94	7.21	10.35	8.19
Fruit	13.37	10.53	11.21	16.23	13.55	19.16	13.26
citrus fruit	2.69	2.06	1.73	3.21	2.76	3.96	2.68
bananas	1.72	1.22	0.81	1.94	1.55	1.75	1.15
apples	2.19	2.22	2.63	2.38	2.21	3.55	3.34
Vegetables	18.67	15.72	16.78	21.56	17.87	25.73	20.78
beets	0.23	0.38	0.59	0.21	0.31	0.40	0.61
carrots	0.78	0.98	1.34	0.77	0.97	1.20	1.46
tomatoes	3.45	3.09	3.34	3.94	3.42	4.90	4.12
Juices [b]	4.00	2.53	1.68	5.14	3.64	2.86	1.85

[a] including non-alcoholic beverages, [b] fruit juices, vegetable juices and fruit-vegetable juices

Source: developed on the basis of unpublished CSO data.

The average monthly expenditures on fresh whole milk, yogurt, curd, ripening and melted cheese in the households located in urban areas in 2014 ranged from PLN 22.27 per capita in the households of employees to PLN 25.69

in the households of retirees and pensioners, and in the households located in rural areas it ranged from PLN 18.38 in the households of employees to PLN 22.33 in the households of retirees and pensioners. The expenditures on fresh whole milk, yogurt, and curds, ripening and melted cheeses are therefore much lower than they should be, so as to consume in accordance with the principles of proper nutrition.

The average monthly expenditures on fish and seafood ranged from PLN 6.07 per capita in households of employees (in rural areas) to PLN 11.99 in households of retirees and pensioners (in urban areas). In order to consume fish and seafood in accordance with nutritional recommendations, one should spend PLN 17.44 per capita a month (the expenditures relate to frozen fillets of hake).

Average monthly expenditures on fruit, vegetables (including fruit, vegetables and fruit-vegetables juices) in households located in urban areas were higher than in households in rural areas. Expenditures in urban areas ranged from PLN 40.78 in the households of employees to PLN 54.87 in the households of retirees and pensioners, whereas in households in rural areas it ranges from PLN 29.84 per capita in the households of farmers to PLN 37.82 in the households of retirees and pensioners.

An approximation of food consumption patterns in Poland to a healthy diet model will take place when expenditures increase on the foodstuffs that have a positive impact on human health.

5. Relationship between income and food consumption

The income obtained by households represents the economic basis of their existence and determines the standard of living, including the level of satisfaction of food needs.

The survey of household budgets conducted by CSO shows that the average monthly available income of 20% of people with the highest income (V quintile group)[8] in households in total in Poland in 2014 amounted to PLN 2,748.25 per capita, and it was 6.8 times higher than the corresponding income of 20% of people receiving the lowest income (I quintile group). In the total number of households, 20% of people with the best income situation had 41.0% of the income of the entire household population group in question whereas 20% of the people in the worst financial situation – 6.4%.

[8] A household is classified into a given quintile group on the basis of per capita available income in that household. Thus members of all the households in the survey are listed according to the increasing per capita available income using the weights applied in the survey and divided into five groups, equal in number of the weighted persons. The first quintile (I) consists of 20% of persons with the lowest incomes, while the fifth quintile (V) – 20% of persons with the highest incomes [CSO 2015a, p. 35].

Table III.9. Average monthly available income and expenditures in households in Poland by quintile groups in 2014 – per capita in PLN

Specification	Total	Quintile groups according to the available income				
		I	II	III	IV	V
Upper limit of quintile group [a]	**-**	**693.84**	**1,010.18**	**1,363.33**	**1,866.67**	**x**
Available income	1,340.44	429.74	832.07	1,149.28	1,548.06	2,748.25
Expenditures	1,078.74	548.80	732.16	939.43	1,225.37	1,951.12
Consumer goods and services	1,031.62	536.74	713.89	909.72	1,173.39	1,827.34
food and non-alcoholic beverages	263.34	185.61	217.50	255.56	299.01	359.35
alcoholic beverages	13.06	5.50	7.33	10.07	15.05	24.42
tobacco	14.17	8.73	11.90	13.07	16.42	20.78
non-food goods and services	724.09	329.81	462.76	611.26	821.05	1,398.05
clothing and footwear	57.78	26.43	37.73	46.33	64.10	114.54
dwelling	269.49	134.96	191.24	245.61	313.52	462.79
housing	216.73	112.75	159.57	204.43	255.24	352.13
electricity gas and other fuels	123.65	67.29	95.32	122.25	148.80	184.78
household equipment	52.76	22.21	31.67	41.18	58.28	110.66
health	53.95	20.86	32.18	49.06	67.38	100.44
personal hygiene	31.34	14.79	20.28	26.05	34.67	61.01
education	11.98	3.99	5.53	8.24	11.85	30.36
recreation and culture	70.13	27.95	37.10	51.93	75.43	158.57
restaurants and hotels	45.09	17.34	23.62	32.63	47.44	104.67
catering services	40.62	16.41	21.98	30.00	43.05	91.84
transport	98.99	42.22	58.72	76.93	109.07	208.39
communications	54.17	31.07	41.92	50.95	60.91	86.13
miscellaneous goods and services	31.17	10.20	14.43	23.54	36.69	71.15
pocket-money	16.96	7.08	14.40	19.76	21.83	21.73
Other expenditures	47.12	12.07	18.28	29.71	52.01	123.79
gifts donated to other households	33.57	6.91	10.35	18.86	37.04	94.91

[a] calculated on the basis of available income

Source: developed on the basis of unpublished CSO data.

Much smaller differences have been observed in the level of average monthly expenditures on consumer goods and services. In households of 20% of people with the highest incomes, they were higher by 240% than the corresponding level of expenditures of 20% of people with the lowest income, and the average monthly expenditures on food and non-alcoholic beverages was higher by 93.6%. Current income of the poorest people in Poland was not enough to cover the expenditures on consumer goods and services (expenditures for this purpose exceeded the available income by 24.9%). This means that 20% of people with the lowest income were forced to use their savings or loans.

As the household income increase, the share of expenditures on food and non-alcoholic beverages (including expenditures on catering services)

decrease in the total expenditures, this is consistent with the Engel's law. This share in households of 20% of people receiving the lowest income (I quintile group) amounted to 36.8%, and in households of 20% of the wealthiest people (V quintile group) it was 23.1%. In other quintile groups, this share was as follows: in the II group – 32.7%, in the III group – 30.4% and in the IV group – 27.9%.

Household budgets of people in the most difficult income situation are burdened primarily by the expenditures on food and non-alcoholic beverages, housing, electricity, gas and other fuels (including the fees for the rental of housing, water supply, waste disposal). Expenditures incurred for this purpose in these holdings represented over 57% of the total expenditures, and in households of the wealthiest people it was 41.2%. The expenditures in other quintile groups for this purpose was as follows: 54.5% – in the II group, 52.2% – in the III group and 48.7% – in the IV group.

The necessity to meet the basic needs of the households of the people receiving the lowest income is the cause of limiting the expenditures incurred in order to meet many other needs, including education, health, recreation and culture. The poorest households had only PLN 222 left per capita a month to meet those needs, and the wealthiest – PLN 1,024. Therefore, the expenditures in the households of 20% of people with the highest income earmarked for education was 7.6 times higher than the expenditures in the households of 20% of the poorest people, 5.7 times higher on recreation and culture and 4.8 times higher on health.

The income situation of households has a very large impact on the diversification and the level of food consumption. As the income grows the consumption of most foodstuffs increases, except for: bread, whole milk, animal fats (excluding butter), margarine and other vegetable fats and potatoes (Table III.10).

Depending on the level of obtained income, the analysis of food consumption showed that households of 20% of the wealthiest people in Poland consumed several times more relatively more expensive foodstuffs than households of 20% of the poorest people, and so: over 2 times more processed vegetable, ripening and melted cheese, ice-cream, bakery products, processed potatoes, fish and seafood, curd, bananas, yogurt, butter, juices, mineral and spring waters, 3 times more dried, smoked or salted fish and citrus fruit, 4 times more processed fruit, 5,7 times more beef and 6,3 times more dried fruit and nuts.

Table III.10. Average monthly consumption of basic foodstuffs in households in Poland by quintile groups in 2014 – per capita

Specification	Unit	Total	Quintile groups according to the available income				
			I	II	III	IV	V
Bread and cereal products	kg	6.26	6.02	6.08	6.28	6.55	6.40
bread	kg	3.94	4.10	3.94	3.95	3.97	3.73
pasta and pasta products	kg	0.37	0.32	0.34	0.37	0.40	0.40
rice	kg	0.17	0.14	0.16	0.18	0.20	0.20
bakery products	kg	0.76	0.48	0.60	0.74	0.89	1.06
Meat, offal and preparations	kg	5.29	4.42	4.90	5.44	5.89	5.80
pork	kg	1.31	1.09	1.21	1.39	1.47	1.40
beef	kg	0.09	0.03	0.05	0.08	0.12	0.17
poultry	kg	1.53	1.29	1.43	1.58	1.70	1.64
processed meat and other meat preparations	kg	2.03	1.72	1.89	2.05	2.24	2.27
poultry processed meat	kg	0.19	0.20	0.19	0.18	0.19	0.19
Fish and seafood	kg	0.33	0.21	0.24	0.32	0.40	0.48
dried, smoked or salted	kg	0.10	0.05	0.07	0.09	0.12	0.15
Milk and processed milk	kg	5.06	4.35	4.66	5.05	5.44	5.73
fresh whole milk	kg	2.05	2.18	2.10	2.07	1.99	1.92
fresh low-fat milk	kg	1.30	1.03	1.18	1.32	1.49	1.48
yogurt	kg	0.50	0.31	0.39	0.49	0.57	0.74
cream	kg	0.36	0.29	0.33	0.37	0.42	0.40
curd	kg	0.43	0.27	0.32	0.41	0.52	0.62
ripening and melted cheese	kg	0.39	0.26	0.33	0.38	0.43	0.54
Eggs	kg	0.60	0.52	0.55	0.60	0.66	0.67
Oils and fats	kg	1.21	1.07	1.15	1.25	1.34	1.25
butter	kg	0.25	0.13	0.18	0.25	0.32	0.38
other animal fats	kg	0.09	0.08	0.08	0.10	0.10	0.07
margarine and other vegetable fats	kg	0.42	0.47	0.45	0.44	0.42	0.33
vegetable oils	kg	0.45	0.39	0.45	0.47	0.49	0.44
Fruit	kg	3.59	2.15	2.73	3.44	4.27	5.38
apples	kg	1.17	0.85	0.99	1.19	1.35	1.49
citrus fruit	kg	0.64	0.34	0.47	0.58	0.78	1.03
bananas	kg	0.48	0.30	0.39	0.48	0.57	0.69
berries	kg	0.47	0.26	0.32	0.44	0.56	0.75
dried fruit and nuts	kg	0.09	0.03	0.05	0.07	0.11	0.19
processed fruit	kg	0.05	0.02	0.03	0.04	0.06	0.08
Vegetables	kg	4,91	3.73	4.32	4.99	5.79	6.52
processed vegetable	kg	0.66	0.45	0.55	0.63	0.77	0.91
Potatoes	kg	3.92	4.02	4.06	3.96	4.05	3.51
Processed potatoes	kg	0.10	0.06	0.09	0.10	0.12	0.13
Chips	kg	0.06	0.05	0.06	0.06	0.06	0.07
Sugar, jam, honey, other products	kg	1.89	1.65	1.78	1.92	2.07	2.05
sugar	kg	1.19	1.18	1.21	1.23	1.26	1.05
confectionery	kg	0.23	0.17	0.19	0.23	0.26	0.30
ice cream	kg	0.22	0.15	0.18	0.22	0.25	0.32
Mineral and spring waters	l	4.17	2.29	3.12	3.98	4.93	6.55
Non-alcoholic beverages	l	3.40	2.88	3.30	3.48	3.50	3.86
Juices	l	0.88	0.52	0.67	0.83	0.99	1.42

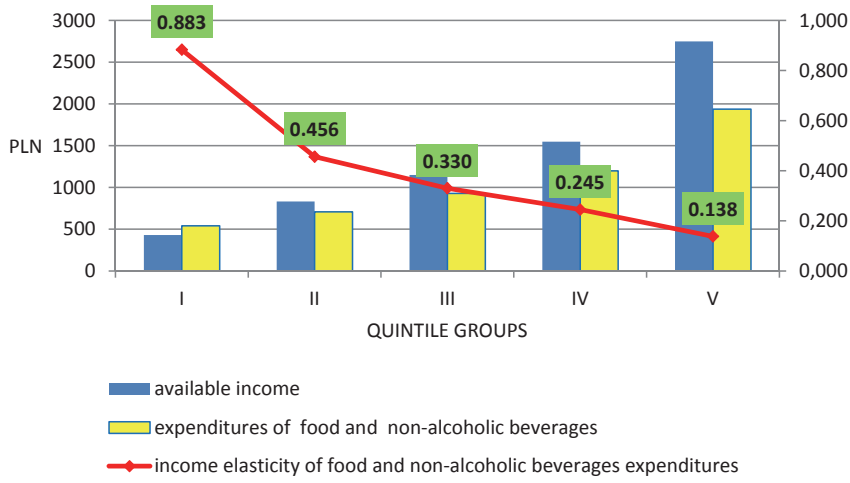
Source: developed on the basis of unpublished CSO data.

7. Income elasticity of demand for food

The response of demand to change in the income is the income elasticity of demand. The measure of this response is a coefficient of income elasticity of demand, which is expressed as a percentage change in demand due to one percentage point change in the income of consumers.

The coefficients of income elasticity of demand (consumption) for foodstuffs tend to be above zero because income growth was generally accompanied by an increase in demand. A negative coefficient value suggests that there is a decrease in demand for a particular good as consumer income grows, and it applies in particular to lower-rank goods, which are replaced by other higher-rank goods when income rises. If the coefficients are higher than one, the demand is perfectly elastic since an increase in income by 1% is accompanied by an increase in demand by over 1% (it applies to higher-rank products), and if they are lower than one, the demand is inflexible and changes more slowly than income (this applies to basic foodstuffs), and when they are equal to zero, the demand is rigid, as in the case of basic goods and the ones necessary for everyday life (e.g. salt, flour). The lower the income elasticity coefficients, the weaker the impact of income on demand (consumption) of foodstuffs.

Figure III.4. Available income, expenditures on food and income elasticity of food expenditures in households by quintile groups in Poland in 2014



Source: developed on the basis of the Table III.9 and own calculations.

A conducted study shows that the income elasticity coefficient of expenditures on food and non-alcoholic beverages for total households in Poland in 2014 amounted to e = 0.282. This means that an increase in the average

available income in households by 1% may cause an increase in expenditures on food and non-alcoholic beverages by 0.28%. With movement from lower to higher income groups, income elasticity coefficients for expenditures on food and non-alcoholic beverages decrease significantly (Figure III.4).

The coefficient of income elasticity of expenditures on food and non-alcoholic beverages for households of the poorest people in Poland is very high e = 0.883, and this confirms that about 20% of the Polish population has unmet food needs.

The coefficients of income elasticity of demand (consumption) for basic foodstuffs in the quantitative terms in the total households by quintile groups are presented in Table III.11. The coefficients of income elasticity of demand (consumption) for most of the analysed foodstuffs in all quintile groups were positive, with the exception of: bread, poultry processed meat, fresh whole milk, margarine and other vegetable fats, potatoes and sugar. The coefficients obtained for these products were negative, which means a decrease in demand for these foodstuffs as the income increases.

An analysis of income elasticity of demand (consumption) for basic food and non-alcoholic beverages for households of 20% of the poorest people in Poland shows that:

1. Higher-rank goods (income elasticity of demand: $e > 1$) include: ice cream, bakery products, bananas, yogurt, curd, fish and seafood, fruit juices, vegetable juices and fruit-vegetable juices, mineral and spring waters, butter, dried, smoked or salted fish, berries, citrus fruit, processed fruit, beef, dried fruit and nuts. This is evidenced by high income elasticity coefficients that for these foodstuffs ranged from e = 1.032 for ice cream to e = 1.732 for citrus fruit and from e = 3.071 for beef to e = 3.946 for dried fruit and nuts.

2. Basic goods (income elasticity of demand: $1 > e > 0$) include: vegetable oils, pasta and pasta products, poultry, non-alcoholic beverages, eggs, chips, pork, processed meat and other meat preparations, cream, rice, fresh low-fat milk, apples, confectionery, ripening and melted cheese and processed vegetable. The coefficients for these foodstuffs from e = 0.200 for vegetable oils to e = 0.478 for fresh low-fat milk and from e = 0.441 for cream to e = 0.949 for processed vegetable.

3. Lower-rank goods (income elasticity of demand: $e < 0$) include: margarine and other vegetable fats, fresh whole milk, potatoes, bread, poultry processed meat and sugar. The coefficients for these foodstuffs were negative and ranged from e = -0.276 for margarine and other vegetable fats to e = -0.042 for potatoes.

Table III.11. Income elasticity of demand (consumption) for foodstuffs in total households in Poland by quintile groups in 2014

Specification	R^2	Total	Quintile groups				
			I	II	III	IV	V
Bread and cereal products	0.83	0.029	0.090	0.047	0.034	0.025	0.014
Bread	0.82	-0.027	-0.084	-0.043	-0.031	-0.023	-0.013
Pasta and pasta products	0.93	0.094	0.293	0.151	0.110	0.081	0.046
Rice	0.96	0.150	0.468	0.242	0.175	0.130	0.073
Bakery products	0.96	0.351	1.095	0.566	0.409	0.304	0.171
Meat and meat preparations	0.95	0.116	0.362	0.187	0.135	0.100	0.057
Pork	0.91	0.113	0.352	0.182	0.132	0.098	0.055
Beef	0.98	0.985	3.071	1.586	1.148	0.853	0.480
Poultry	0.94	0.105	0.328	0.169	0.123	0.091	0.051
Processed meat and other meat preparations	0.95	0.114	0.355	0.184	0.133	0.099	0.056
Poultry processed meat	0.68	-0.025	-0.077	-0.040	-0.029	-0.021	-0.012
Fish and seafood	0.93	0.397	1.239	0.640	0.463	0.344	0.194
Dried, smoked or salted fish	0.96	0.534	1.664	0.860	0.622	0.462	0.260
Milk and processed milk products	0.94	0.109	0.339	0.175	0.127	0.942	0.053
Fresh whole milk	0.92	-0.043	-0.135	-0.069	-0.050	-0.037	-0.021
Fresh low-fat milk	0.95	0.153	0.478	0.247	0.179	0.133	0.075
Yogurt	0.95	0.393	1.226	0.633	0.458	0.340	0.192
Cream	0.93	0.142	0.441	0.228	0.165	0.123	0.069
Curd	0.94	0.393	1.226	0.633	0.458	0.340	0.192
Ripening and melted cheese	0.95	0.304	0.947	0.489	0.354	0.263	0.148
Eggs	0.92	0.110	0.342	0.177	0.128	0.095	0.054
Oils and fats	0.87	0.075	0.235	0.122	0.088	0.065	0.037
Butter	0.97	0.506	1.579	0.815	0.590	0.438	0.247
Margarine and other vegetable fats	0.74	-0.088	-0.276	-0.142	-0.103	-0.077	-0.043
Vegetable oils	0.77	0.064	0.200	0.103	0.075	0.055	0.031
Fruit	0.95	0.429	1.339	0.691	0.501	0.372	0.209
Apples	0.96	0.237	0.739	0.382	0.276	0.205	0.116
Citrus fruit	0.95	0.555	1.732	0.894	0.648	0.481	0.271
Bananas	0.96	0.365	1.139	0.588	0.426	0.316	0.178
Berries	0.94	0.551	1.719	0.888	0.643	0.477	0.269
Dried fruit and nuts	0.98	1.265	3.946	2.038	1.476	1.095	0.617
Processed fruit	0.97	0.765	2.387	1.233	0.892	0.663	0.373
Vegetables	0.94	0.234	0.730	0.377	0.273	0.203	0.114
Processed vegetable	0.94	0.304	0.949	0.490	0.355	0.263	0.148
Potatoes	0.52	-0.029	-0.091	-0.047	-0.034	-0.025	-0.014
Chips	0.92	0.112	0.351	0.181	0.131	0.097	0.055
Sugar	0.20	-0.013	-0.042	-0.022	-0.016	-0.012	-0.007
Confectionery	0.93	0.241	0.753	0.389	0.381	0.209	0.118
Ice cream	0.93	0.331	1.032	0.533	0.386	0.286	0.161
Mineral and spring waters	0.96	0.503	1.568	0.810	0.586	0.435	0.245
Non-alcoholic beverages	0.98	0.105	0.329	0.170	0.123	0.091	0.051
Juices	0,93	0.489	1.524	0.787	0.570	0.423	0.238

Source: calculated on the basis of on average monthly available income and the consumption of foodstuffs according to the log-hyperbolic function.

An analysis of income elasticity of demand for basic food and non-alcoholic beverages, calculated for households of 20% of the wealthiest people in Poland shows that:

1. Lower-rank goods include: margarine and other vegetable fats, fresh whole milk, potatoes, bread, poultry processed meat and sugar, whereas the basic goods – other foodstuffs.

2. The coefficients close to zero were obtained for many foods: vegetable oils, pasta and pasta products, poultry, eggs, pork, chips, processed meat and other meat preparations, cream, rice and fresh low-fat milk. These foodstuffs show minimal sensitivity to a change in income of the wealthiest consumers. The coefficients for these foodstuffs ranged from e = 0.031 for vegetable oils to e = 0.075 for fresh low-fat milk.

3. The coefficients of income elasticity of demand (consumption) for all basic foodstuffs are low and very low, which means that the market is close to foodstuffs saturation.

The analysis of the correlation between income and consumption of food and non-alcoholic beverages shows that the degree of meeting food needs in households of 20% of the poorest people in Poland is unsatisfactory. It is evidenced by a low level of consumption of many food products and high coefficients of income elasticity of demand for most foodstuffs and income elasticity of food expenditures (e = 0.883). This means that at least 7.7 million people in Poland have unmet food needs.

8. Forecast of changes in demand for food

The presented results of the econometric analysis of the impact of consumers' income on food consumption by coefficients of income elasticity of demand have not only an cognitive value, but they are also practical.

Knowledge of income elasticity of demand for food makes it possible to anticipate changes in the size structure of consumer demand that occur under the influence of increased level of affluence of the Polish society, which is a result of the country's economic growth. Inference on the basis of income elasticity coefficients about the changes in the demand for food can take place only on the assumption that the analysed period is representative and that the basic parameters of the country's economic development will be similar as in the period in question.

By means of the *ceteris paribus*, it is possible to determine how the demand for food will change due to the changes in consumer income. Therefore, with an increase in consumer income by 1%, the consumption of food products changed by the percentage shown in coefficients of income elasticity of demand.

Suppose that the real income of the population in the next five years increased by 15% equally in all analysed income groups, i.e. in the quintile groups of available income. With the coefficients of income elasticity of demand, it is possible to predict how the demand (consumption) for basic foodstuffs will change due to changes in consumer income.

For example, the demand for yogurt in households of 20% of the poorest people in Poland will increase by 18.4%, for fish and seafood – by 18.6%, for juices – by 22.9%, for mineral and spring waters – 23.5%, for citrus fruit – by 26.0%, for beef – by 46.1%, for dried fruit and nuts – by 59.2% and the demand for margarine and other vegetable fats will decrease – by 4.1% (Table III.12).

Table III.12. Forecast of changes in demand for selected foodstuffs for 2019 in total households in Poland by quintile groups – in percentage

Specification	Total	Quintile groups				
		I	II	III	IV	V
Bread	-0.4	-1.3	-0.6	-0.5	-0.3	-0.2
Bakery products	5.3	16.4	8.5	6.1	4.6	2.6
Meat, offal and preparations	1.7	5.4	2.8	2.0	1.5	0.9
Pork	1.7	5.3	2.7	2.0	1.5	0.8
Beef	14.8	46.1	23.8	17.2	12.8	7.2
Poultry	1.6	4.9	2.5	1.8	1.4	0.8
Fish and seafood	6.0	18.6	9.6	6.9	5.2	2.9
Dried, smoked or salted fish	8.0	25.0	12.9	9.3	6.9	3.9
Fresh whole milk	-0.6	-2.0	-1.0	-0.8	-0.6	-0.3
Fresh low-fat milk	2.3	7.2	3.7	2.7	2.0	1.1
Yogurt	5.9	18.4	9.5	6.9	5.1	2.9
Cream	2.1	6.6	3.4	2.5	1.8	1.0
Curd	5.9	18.4	9.5	6.9	5.1	2.9
Ripening and melted cheese	4.6	14.2	7.3	5.3	3.9	2.2
Eggs	1.7	5.1	2.7	1.9	1.4	0.8
Butter	7.6	23.7	12.2	8.9	6.6	3.7
Margarine and other vegetable fats	-1.3	-4.1	-2.1	-1.5	-1.2	-0.6
Fruit	6.4	20.1	10.4	7.5	5.6	3.1
Apples	3.6	11.1	5.7	4.1	3.1	1.7
Citrus fruit	8.3	26.0	13.4	9.7	7.2	4.1
Bananas	5.5	17.1	8.8	6.4	4.7	2.7
Berries	8.3	25.8	13.3	9.6	7.2	4.0
Dried fruit and nuts	19.0	59.2	30.6	22.1	16.4	9.3
Processed fruit	11.5	35.8	18.5	13.4	9.9	5.6
Vegetables	3.5	11.0	5.7	4.1	3.0	1.7
Processed vegetable	4.6	14.2	7.4	5.3	3.9	2.2
Potatoes	-0.4	-1.4	-0.7	-0.5	-0.4	-0.2
Chips	1.7	5.3	2.7	2.0	1.5	0.8
Sugar	-0.2	-0.6	-0.3	-0.2	-0.2	-0.1
Confectionery	3.6	11.3	5.8	5.7	3.1	1.8
Ice cream	5.0	15.5	8.0	5.8	4.3	2.4
Mineral and spring waters	7.5	235	12.2	8.8	6.5	3.7
Juices	7.3	22.9	11.8	8.6	6.3	3.6

Source: developed on the basis of Table III.11.

This means that the level of consumption of yogurt in households of 20% of the poorest people will increase from 3.7 kg per capita per year in 2014 to 4.4 kg in 2019, for fish and seafood – from 2.5 to 3.0 kg, for juices – from 6.2 to 7.7 litres, for mineral and spring water – from 27.5 to 33.9 litres, for citrus fruit – from 4.1 to 5.1 kg, for beef – from 0.4 to 0.5 kg, for dried fruit and nuts – from 0.3 to 0.6 kg, whereas the level of consumption of margarine and other vegetable fats will decrease from 5.6 to 5.4 kg.

Households of the wealthiest people respond in a different way to the changes in income than the households in the most difficult income situation. Demand for yogurt, fish and seafood, juices, mineral and spring water, citrus fruit will also increase, but to a much lesser extent – from 2.9% for yogurt to 4.1% for citrus fruit, unlike in the households of the poorest people – from 18.4 to 26.0%.

This means that yogurt consumption level in the households of the wealthiest will increase from 8.9 kg per capita a year in 2014 to 9.1 kg in 2019, i.e. by 0.2 kg, for fish and seafood – by 0.1 kg, for juices – by 0.7 l, for mineral and spring waters – by 2.9 l, for citrus fruit – by 0.5 kg, whereas the level of consumption of margarine and other vegetable fats will decrease by 0.1 kg.

It should be expected that the increase in income of the households of 20% of the poorest people in Poland will increase the demand mainly on dried fruit and nuts, beef, processed fruit, fruit juices, berries, dried, smoked or salted fish, mineral and spring waters, juices and yogurt. Changes in the demand for these foodstuffs will be stronger than the changes in the income.

An increase in income will not have a significant impact on the consumption of sugar and potatoes since with improving financial situation of households of 20% of the poorest people, the demand for higher-rank goods increases.

The households of 20% of the wealthiest people in Poland will see an increase mainly in the demand for confectionery, mineral and spring waters, juices, beef and yogurt.

An analysis of the correlation between the income and the consumption of the food shows that the prospects for the food industry are enormous because with the increase in consumer income, the demand for highly processed products will increase as well.

9. Prices of food and non-alcoholic beverages

An important factor that determines the changes in the level and structure of food consumption is also the price. It determines the real value and purchasing power of income in the given socio-economic conditions in the country. Sojkin [1994] believes that any price should fulfil two basic functions: balancing of supply and demand and providing information and besides

it should force a potential buyer to reflect on the rationality of their actions. The price affects consumption in a secondary way because the level and structure of consumption directly depends on the income earned by households. However, the level of income reflects the real possibility of consumption only when confronted with the prices.

Table III.13. Price indices of consumer goods and services and indices of nominal and real wages and salaries in 2009-2014

Specification	2009	2010	2011	2012	2013	2014	
	previous year = 100						2009=100
Consumer goods and services	103.5	102.6	104.3	103.7	100.9	100.0	112.0
Food and non-alcoholic beverages	104.1	102.7	105.4	104.3	102.0	99.1	114.2
Food	104.1	102.8	105.6	104.3	102.2	99.1	114.8
bread	103.1	103.5	112.0	102.3	100.5	99.8	119.0
meat [a]	108.4	98.6	105.2	108.4	101.8	98.9	113.1
beef	110.0	103.7	109.8	114.3	102.3	98.9	131.7
pork	108.2	95.3	104.6	110.3	100.8	97.0	107.6
poultry	109.9	96.0	112.9	106.0	100.0	97.2	111.7
processed meat and other meat preparations	107.8	100.4	102.8	107.8	102.8	100.3	114.6
fish and seafood	108.4	103.8	106.2	108.5	101.1	100.0	120.9
milk	99.3	100.6	104.5	103.0	102.2	105.0	116.2
yogurt, beverages and dairy desserts	98.0	100.2	103.4	104.5	101.7	103.4	113.8
ripening and melted cheese	92.5	105.1	105.6	103.0	102.8	104.2	122.4
eggs	108.7	105.4	98.5	131.9	93.3	93.7	119.7
oils and fats	101.8	105.4	107.6	103.7	102.1	99.7	119.7
butter	96.9	115.0	108.3	98.8	104.2	102.5	131.4
margarine and other vegetable fats	101.6	102.8	106.9	105.4	100.2	98.9	114.7
fruit	95.8	109.2	109.3	101.8	102.2	97.2	120.7
vegetables	104.5	114.1	96.1	93.6	110.7	96.4	109,6
sugar	114.9	89.3	148.2	98.4	91.7	71.2	85.0
mineral waters, fruit juices, vegetable juices	103.1	101.3	101.8	102.5	100.7	100.0	106.4
alcoholic beverages	106.1	101.8	100.9	100.9	101.1	101.9	106.7
tobacco	115.7	111.9	109.0	108.8	107.5	107.0	152.7
Average monthly gross nominal wages and salaries	105.4	103.9	105.6	103.7	103.7	103.4	122.0
gross real wages and salaries [b]	102.0	101.4	101.4	100.1	102.8	103.4	109.4

[a] until 2013 excluding raw bacon included in item "Oils and fats", [b] chain indices (previous year = 100) were calculated as the ratio of the index of the average monthly gross nominal wages and salaries and price index of consumer goods and services for households of employees.

Source: developed on the basis of [CSO 2014b, CSO 2015b, and CSO 2015c].

In 2009-2014, the prices of food and non-alcoholic beverages have increased by 14.2%, with the real average monthly gross wages and salaries increase by 9.4%. During the period in question, the prices increased most for the following foodstuffs: beef (by 31.7%), butter (by 31.4%), ripening and melted cheese (by 22.4%), fish and seafood (by 20.9%), fruit (by 20.7%), eggs (by 19.7%), bread (by 19.0%), milk (by 16.2%), margarine and other vegetable fats (by 14.7%), processed meat and other meat preparations (by 14.6%), yogurt, milk-based beverages and desserts (by 13.8%) and, to a lesser extent, poultry (by 11.7%), pork (by 7.6%), vegetable (by 9.6%), mineral waters, fruit juices, vegetable juices and non-alcoholic beverages (by 6.4%), and least – alcoholic beverages (by 15.1%). Sugar prices fell by 25.0%. Price indices of consumer goods and services and indices of average monthly wages and salaries in nominal and real terms in 2009-2014 are presented in Table III.13.

Prices of food and non-alcoholic beverages in almost all analysed years grew at a faster rate than the general prices of consumer goods and services. The share of expenditures on food in the total consumer expenditures declined in the period in question, which probably was the result of growth of average wages in the national economy. Therefore, wage growth has made it possible to keep the economic availability of food at a stable level.

In the years 2013-2014 food and non-alcoholic beverages have become cheaper by 0.8%, while growth in real average monthly gross wages and salaries was by 3.4%. Prices of bread, meat, eggs, margarine and other fats, fruits, vegetables and sugar declined, fish and seafood, mineral waters, fruit juices, vegetable juices and non-alcoholic beverages remained at the same level, while the other analysed foodstuffs have increased – from 2.5% for butter to 5.0% for milk.

The surveys conducted by the Warsaw University of Life Sciences show that, when buying foodstuffs, respondents considered the following factors *very important* or *important*: 83.6% of them indicated the price, 55.3% – nutritional value, 54.2% – no preservatives or other chemical additives, 44.8% – Polish origin of the product, 35.8% – ecological way of food production and 31.1% – a low degree of processing [Gutkowska and Ozimek 2005].

10. Economic poverty in Poland

The Central Statistical Office has adopted three economic poverty lines: (1) extreme poverty line, (2) statutory poverty line and (3) relative poverty line[9].

[9] Since 1990s, the CSO has published data on the coverage of economic poverty estimated on the basis of household budget surveys, using various poverty lines.

1. The extreme poverty line (subsistence minimum level) is calculated by the Institute of Labour and Social Affairs (IPiSS). It includes only the needs whose satisfaction cannot be postponed and the consumption below this level leads to biological destruction.
2. The statutory poverty line (social intervention threshold) – defined as the amount that ensures eligibility for the award of cash benefits from social assistance in compliance with the law on social assistance.
3. The relative poverty line – defined as 50% of the average expenditure of total households (calculated on the basis of the household budget survey).

In the case of extreme poverty and relative poverty, in order to eliminate the impact exerted on the cost of maintaining a household by the socio--economic impact, the Central Statistical Office uses the original equivalence scale of the OECD (*Organisation for Economic Co-operation and Development*) both in calculating the level of expenditure in households and in determining the poverty lines[10].

In the case of a statutory poverty, two thresholds apply in the calculation of the poverty lines: (1) for a single person household – a one-person household and (2) for a person in a household consisting of many people[11].

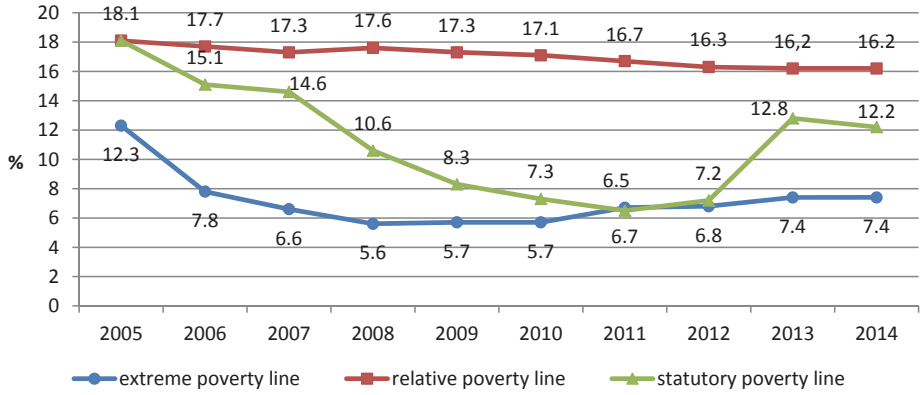
The survey of household budgets conducted by the Central Statistical Office shows that compared with the previous year, the financial situation of households in Poland has improved in 2014. At the same time, there were no significant changes in economic poverty. The rates of extreme poverty and relative poverty remained at the same level for the extreme poverty (7.4%) and for the relative poverty (16.2%)[12]. The range of the statutory poverty declined by 0.6 pp. Changes in the poverty range in Poland in 2005-2014 according to the poverty lines accepted in a given year are presented in the Figure III.5.

[10] According to the original OECD equivalence scale, a weight of 1 is assigned to the first person in a household aged 14 or more, a weight of 0.7 – to every next person of this age, a weight of 0.5 – to every child under the age of 14. This means that the poverty line for a household consisting of four people, including two adults and two children under the age of 14 is 2.7 times higher than for a one-person household.

[11] New indexed threshold values for social intervention have been applied since October 2012. For a single person household, it is PLN 542, and for a person in a household consisting of many people, it is PLN 456. Previously, for six years, this amount for a single person household was PLN 477, and for a person in a household consisting of many people, it was PLN 351.

[12] The basic measure to evaluate the range of poverty is the poverty rate, i.e. the percentage of people in households where the level of expenditures (including the value of products obtained for free and the value of natural consumption) was lower than the adopted poverty line.

Figure III.5. Poverty range in Poland in 2005-2014 – in the percentage of people in households



Source: developed on the basis of [CSO 2015, p. 289].

The Central Statistical Office data show that about 2.8 million people lived in households with expenditures below the extreme poverty line in 2014, about 6.2 million people lived in households below the relative poverty line and about 4.6 million lived in households below the statutory poverty line [CSO 2015 d].

However, the average rates in particular groups do not reflect the situation of the sections of the population that is the most vulnerable in terms of income. Economic availability of food for poor households is often much smaller than for the rest of the population.

The scale of poverty in Poland in 2005-2014 decreased, but it still affects a large part of the population. This means that groups with lower income may have limited access to food. An increase in food prices causes that it becomes less available especially for families with the lowest incomes.

This difficult situation in terms of nutrition of numerous families in Poland is confirmed by the results of the survey under the *European Union Statistics on Income and Living Conditions* (EU-SILC), which was conducted throughout the country in the period of 4-20 July 2014 by the Central Statistical Office. The EU-SILC survey is a voluntary, representative survey of private households, conducted by means of direct interview with the respondents[13].

[13] EU-SILC organisation and methodology is governed by the Regulation (EC) No. 1177/2003 of the European Parliament and of the Council of 16 June 2003 (with amendments included in regulation No. 1553/2005) concerning Community Statistics on Income and Living Conditions (EU-SILC) along with regulations of the European Commission corresponding to that legal act [CSO 2014c].

The aim of this study is to provide comparable data for European Union countries about the living conditions of the population.

The households participating in the survey evaluated, among other things, their financial situation. Only 1.1% of households declared that, with the current income, they find it *very easily* "to make ends meet", *easy* – 6.8%, *quite easily* – 21.2%, *a bit difficult* – 35.6%, *difficult* – 20.3% and *very difficult* – 15.0% [CSO 2014c].

Households located in rural areas are in a more difficult financial situation than the households located in urban areas. Only 0.5% of households located in rural areas declared that they find it *very easy* "to make ends meet" with the current level of income (in urban – 1.4%), *easy* – 4.3% (in urban – 8.1%), *quite easy* – 18.5% (in urban – 22.6%), *a bit difficult* – 39.8% (in urban – 33.5%), *difficult* – 22.0% (in urban – 19.4 %), and *very difficult* 14.9% (in urban – 15.0%).

The households also evaluated the difficulties in meeting the needs, including: (1) eating meat or fish every second day, (2) heating the housing as needed, (3) a week-long rest of the family once a year. The most difficult situation was in households of retirees and in the households of pensioners, and the best in the households of the self-employed. Much greater difficulties in meeting the needs were declared by households located in rural areas. The difficulties of households in meeting the needs in Poland in 2013 are shown in Table III.14.

Table III.14. Difficulties of households in meeting the needs in Poland in 2013

Specification	Eating meat or fish every second day	Heating the housing as needed	A week-long rest of the family once a year
	Percentage of households that declare it is impossible for them to meet the given needs		
Total	14.9	13.1	58.9
Employees	10.9	9.6	53.0
Farmers	9.9	9.2	67.6
Self-employed	5.3	8.6	34.2
Retirees	17.6	16.0	65.5
Pensioners	30.7	23.4	82.1
Urban	13.4	12.3	52.5
Rural	17.8	14.8	71.6

Source: developed on the basis of [CSO 2014b, Table 33, and p. 103].

Failure to meet food needs results in the threat of malnutrition, which causes serious health consequences, in particular for children. A study by UNICEF's Innocenti Research Centre shows that 14.5% of children in Poland are at risk of relative poverty, defined as living in a household with income that, given the family size and composition, is less than 50% of the median income in the country in which the children live [UNICEF 2012].

Protecting the poorer population against malnutrition should be one of the most important tasks of food policy. However, food aid to the poorest families will not eradicate the problem of malnutrition. Other solutions should be looked for. One of them should be the reduction of unemployment, which would certainly help to reduce the number of people using food aid. Only increasing incomes of the poorest people, yet not the incomes from social assistance benefits, but from labour, will reduce the number of the people suffering from malnutrition and contribute to the increased demand for most foodstuffs, which, as of today, are higher-rank goods, which are therefore unavailable to many families in Poland.

Conclusions

1. Food security is of fundamental importance to human existence. Food security consists of four dimensions: physical availability of food, economic availability of food, health quality of food and ensuring the stability of the first three dimensions of food security in time.

2. The income and prices in the socio-economic conditions in Poland are the most important factors that have impact on food consumption. Both of these factors determine the economic availability of food.

3. Most of the foodstuffs necessary for proper nutrition are available on the Polish market, and proper nutrition is a prerequisite for human development, physical fitness, intellectual development, well-being and good health condition.

4. Economic availability of food is at a stable level in Poland, among other things thanks to higher wages and salaries in the country. However, many households among the weakest parts of the society have declared inability to eat meat or fish every second day.

5. An analysis of food security at the household level in Poland showed that degree of satisfaction of food needs in households of the poorest 20% in 2014 was unsatisfactory. It is evidenced by the low level of consumption of many basic foodstuffs, high coefficients of income elasticity of demand (consumption) for most foodstuffs and a relatively high income elasticity coefficient of expenditures on food and non-alcoholic beverages. This means that at least 7.7 million people in Poland have unmet food needs. Most people

who cannot afford adequate food are the people excluded from the labour market, but also working people, yet with very low wages and salaries, and most families with many children whose funds are so small that they are not sufficient to satisfy basic needs. In Poland there is no hunger in the strict sense, but there is a deficiency of caloric value, protein, vitamins and minerals in the daily diet of many Polish families.

6. Failure to meet food needs results in the threat of malnutrition, which causes serious health consequences, in particular for children. Poland is among the countries with the highest risk of poverty of children and adolescents among the countries belonging to the European Union. According to the report of the European Commission, every fourth child in Poland is at risk of poverty. Malnutrition affects the children living primarily in large families and families with financial difficulties, and not in pathological families.

7. The best means of improving the nutrition of the poorer population would be to increase economic availability of food as a result of increased income, yet not only by increased social assistance benefits and the number of people using it, but by increasing employment and labour income. This will contribute to an increased demand for most foodstuffs, which, as of today, are higher-rank goods, which are therefore unavailable to many families in Poland. Without reducing the unemployment, the number of people in need of food aid will increase.

8. An improvement in the income of the poorest households in Poland is an opportunity for the development of Polish agriculture. With increased income, such households spend relatively more on food than the households of the wealthiest people. Growing demand for food in the poorest families might increase the domestic demand for agricultural products and foodstuffs.

9. The diet of the population in Poland is incompatible with the principles of rational nutrition. It is evidenced by a high proportion of energy derived from fat intake in the caloric value of the daily food consumption (over 30%) and a low level of consumption of foodstuffs that have a favourable impact on human health. A prerequisite for achieving rational nutrition is primarily an increase in income of the population and dissemination of knowledge about food and nutrition, which is one of the tasks of food policy.

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