

FOOD SELF-SUFFICIENCY OF THE EUROPEAN UNION COUNTRIES – ENERGETIC APPROACH

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Abstract. The paper covers the issues of a basic social need, namely alimentation. The aim of the research is to evaluate the energetic food self-sufficiency and its changes in the European Union countries. The research was conducted using the author's methodology basing on the amount of energy produced and consumed in 1990–2009. The analyses proved that within the considered period, the European Union became an importer of net energy comprised in agricultural products. The excess in produced energy was mainly observed by the countries of European lowland. Moreover, in most of the countries, a decrease in the analysed factor was observed when compared with the 1990–1999 period. On the other hand, in relation to the new member states, the increase in food energetic self-sufficiency was observed. The conclusion has been drawn that, while the general food self-sufficiency is mainly determined by environmental factors, its dynamics is primarily influenced by the factors connected with agricultural policy.

Key words: self-sufficiency, energy, European Union

INTRODUCTION

Nowadays, feeding the world population reaching over 7 billion people depends almost entirely on the agricultural production supply. Biological necessity of food consumption places agriculture among strategic economic sectors, hence creating appropriate conditions for its development is every country's concern. The feed function of agriculture implementation possibilities in

respective states is diametrically different. It is a result of both environmental conditions, like a kind and quality of soil, and socio-economic ones including, among others, the quality of human resources and social capital, the level of economic development and resources of agricultural capital. As Richards et al. (2016) argue "(...) the decades of policies for intensive agriculture have not alleviated hunger and malnutrition, with an absence of food security featuring in both economically developing and developed nations".

Although the problem of providing food security to mankind has always been present, its first definition was coined in the second half of the twentieth century. The concept has been evolving in the following years through the addition of the demand, supply and health aspects (Ecker and Breisinger, 2012; Pangaribowo et al., 2013). The issues related to the theory and policy of food security are widely discussed in academic world and among development organizations. The unit of food security analysis range from the world in total, to a country, a region, a community, down to a household or a single individual. Furthermore, from an economic point of view, the approach can focus on a single sector, a cluster of sectors (e.g. "food system") or can be economy-wide (e.g. Anderson, 2013; Lawrence and McMichael, 2012; Nair, 2014; Rosen and Meade, 2015; Sage, 2013; Widanage, 2013). There are also different approaches to food security such as: food availability, income-based, basic needs, entitlement and sustainable livelihoods (Burchi and De Muro, 2016).

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In 1996 at the World Food Summit, there were stated some principles defining the bases of maintaining food safety by a given country. The choice of strategy aiming at their implementation is dependent of the given country's production supplies and system and institutional situation in political, economic and social areas. In this context, there are three main kinds of solutions in agri-food policy of the given country viewing food safety provision. Their goals are (Pieters et al., 2012): food self-reliance, food self-sufficiency and food sovereignty. The first of the strategies assumes generation and export of the products of a comparative advantage for the given country, which allows, among other things, to gain financial resources necessary to import the other agricultural products, while the grounds for the other two strategies are domestic production and its growth regarding to essential agricultural products, despite the lack of comparative advantages in their production¹. The strategy based on food self-sufficiency which delimits the role of foods import became particularly important during the last economic crisis in 2008. Many countries recognized it as one of key priorities of their agri-food policy.

Usually, the food self-sufficiency of a given country is understood as the ability of food-generating economic sectors to meet the domestic demand for it². The demand includes food consumption, non-consumer food-processing, losses and, in the case of crop production, also the part of it which has been spent on feed and seed. The above concept of self-sufficiency has been employed by the Food and Agriculture Organization of the United Nations (FAO) and the European Union. It indicates the degree of meeting the internal needs for particular, principal agri-food products of the internal production within the area (of a state or a group of states)³. It does

¹ As it has been stressed by Pieters et al. (2012), both the rights to food and its production are equally important in the concept of food sovereignty. This idea emphasizes the role of family and ecological farming and the fair share in means of production. The concept of food sovereignty was created by the Via Campesina chain of agricultural organizations during the FAO World Food Summit in 1996.

² More about food security measurement tools see inter alia in Cafiero et al. (2014) and Burchi and De Muro (2016).

³ It does not mean, however, that in all households in the given country the needs for all food products are met. In many countries being net food exporters, a large number of households suffer from malnutrition (FAO, 2003).

not enable the total assessment of this phenomenon in a country or a group of countries. The paper attempts to analyse food self-sufficiency on an aggregated level including the generated and consumed energy. This approach shows the level of realization of a basic and irreducible function of agricultural production ultimately aimed at providing people with the necessary amount of life energy. The main aim of the research is to evaluate the energetic food self-sufficiency and its changes in the European Union generally and on the member states level.

MATERIALS AND METHOD

The research has been conducted using the author's methodology basing on assessment of energetic food self-sufficiency. The analysis aimed at indicating the amount of energy (calories) produced by each country in the consecutive years has been conducted at the first stage of the research. As the above variable has not been published in the global bases, it has been calculated using the following algorithm:

$$E_w = \sum_{i=1}^n E_{s_i} \cdot P \cdot W_i$$

where:

E_w – amount of energy coming from agricultural production (kcal per country)

E_{s_i} – average use of energy of i -agricultural product (kcal per person)

P – population (residents per country)

W_i – food self-sufficiency coefficient for the i -product estimated using the following formula:

$$W_i = P_i / Z_i \cdot 100\%$$

where:

P_i – production of the i -product (t per country)

Z_i – domestic consumption of i -product (t per country)

In the second stage of the research the energetic food self-sufficiency coefficient has been calculated according to the formula:

$$W_s = E_w / \sum E_{s_i} \cdot 100\%$$

where:

W_s – energetic food self-sufficiency coefficient

E_w – amount of energy coming from agricultural production (kcal per country)

E_{s_i} – energy of all consumed agricultural products (kcal per country)

The indicator represents the relationship between the amount of energy coming from agricultural production and consumed by the inhabitants of a given country in a definite time unit. The value of the index above 100 means that the country is an “exporter” of the net energy produced in agriculture. When the index is below 100, it means the country is an “importer” of the energy.

The analyses have been conducted using the dynamic approach with regard to average values for the 1990–1999 and 2000–2009 decades. Due to the elimination of temporal changeability caused mainly by environmental factors but also by economical or political ones, the decades instead of the consecutive years have been taken into account in the analysis. The FAOSTAT data have been used in the research.

RESEARCH RESULTS

Several basic regularities can be observed during the analysis of the level and dynamics of the energetic food self-sufficiency coefficients both on the European Union and each member states level between 1990–2009 (Table 1, Fig. 1). In the analysed period, the coefficient of food self-sufficiency higher than 100 occurred mainly (apart from Finland) in the European lowland countries spreading from Lithuania to France. These are the areas with the prevalence of lowlands (except Slovakia), temperate climate and good soils. The above fact suggests that, despite the development of technology, biology and chemical fertilization, the agricultural production possibilities still significantly depend on natural conditions. The influence of the environment can be even more observed in the fact that among the countries being agricultural energy net exporters there are both old and new member states and the countries of different agrarian structure and production intensity. The importance of natural factors can also be concluded from the fact that the vast majority of the European Union member states occupied the same positions as net energy exporters (the coefficient higher than 100) or its net importers. Only Poland and Slovakia moved from the position of a net importer to exporter, however, the absolute changes were relatively low. The opposite situation took place

in Belgium and Luxembourg. Unaffected production capacities of nature are modified by the human factor, which plays a vital role in agricultural production. Denmark can be an example of a country characterized by both favourable natural conditions and intense (mainly animal) production. Due to the above, the coefficient is the highest in this country for both periods. The net importers are mainly southern and northern European states, where the agricultural production conditions are less favourable, but also United Kingdom where the role of agriculture in the national economy is less significant.

There was a decrease in the coefficient level in the EU when referring to the compared periods. What more, while the EU in general was a net energy exporter in 1990–1999⁴, it became its importer in 2000–2009 – the coefficient level was respectively: 102 and 97. However, it should be noted that the loss of food self-sufficiency had no impact on the level of alimentation of European societies. In both analysed decades the average amount of energy consumed was usually higher than 2200 kcal/day, which is considered the lower limit of the recommended consumption (Michna, 1998). An exception in this respect is Slovenia, which in both periods received a value slightly lower than the specified standard.

The deficit of the food self-sufficiency in the EU was also emphasized in the research by Noleppa and Carstburg (2013) with the application of a different methodology. As the authors prove, the deficit of energy contained in all the agricultural products generated in the European Union is the result of insufficient vegetable products supply in comparison with the demand. At the same time, an excess in energy from animal production was noticed⁵. It can be concluded that this state of things is largely determined by political factors, including all the CAP reforms carried out in the last decades. After the years of overproduction of food resulting from the production support, different measures of CAP were mainly aimed at extensification of agriculture (including the reduction of its harmful impact on the environment),

⁴ All the European Union countries have been included in the research, no matter if they already were its members in 1990–2009 or not.

⁵ Nowadays, the European Union is one of the world's greatest importers of raw oil and its products. The lowest self-sufficiency level has been noted with regard to soya – less than 10%. The demand for self-sufficiency also concerns fruits. On the other hand, production of pork, beef and veal significantly exceeds the internal market needs (Baer-Nawrocka, 2014).

Table 1. Coefficient of food self-sufficiency in the European Union¹ countries and its dynamics in 1999–2009

Tabela 1. Współczynnik energetycznej samowystarczalności żywnościowej w krajach Unii Europejskiej i jego dynamika w latach 1999–2009

Country Kraj	Energetic self-sufficiency coefficient (average) Współczynnik energetycznej samowystarczalności żywnościowej (średnia dla lat)			Dynamics (1990–1999 = 100) Dynamika (1990–1999 = 100)	
	1990–1999	2000–2009	2004–2009	2000–2009	2004–2009
Bulgaria – Bułgaria	94	99	101	104	107
Croatia – Chorwacja ²	91	89	91	98	101
Czech Republic – Czechy ²	109	104	106	95	97
Estonia ²	84	78	82	93	98
Lithuania ² – Litwa ²	105	107	110	102	105
Latvia ² – Łotwa ²	89	88	93	99	104
Poland – Polska	100	101	104	102	104
Romania – Rumunia	97	89	91	92	93
Slovakia ² – Słowacja ²	100	104	107	105	108
Slovenia ² – Słowenia ²	69	69	69	100	99
Hungary – Węgry	120	117	120	97	100
EU-12/UE-12	101	99	101	98	101
Austria	95	96	96	100	100
Belgium and Luxemburg Belgia i Luksemburg	112	99	98	88	87
Denmark – Dania	157	147	146	94	93
Finland – Finlandia	106	105	103	99	98
France – Francja	138	129	126	93	91
Greece – Grecja	95	82	79	86	83
Spain – Hiszpania	96	91	88	95	92
Netherlands – Holandia	116	114	116	98	100
Irleand – Irlandia	140	114	108	81	77
Germany – Niemcy	105	102	101	97	96
Portugal – Portugalia	67	64	63	95	94
Sweden – Szwecja	95	91	88	96	93
United Kingdom – Wielka Brytania	84	76	75	91	89
Italy – Włochy	85	76	73	89	86
EU 15 – UE 15	103	96	94	93	92
EU – UE	102	97	96	94	93

¹Cyprus and Malta have not been included due to the low importance of agriculture in these countries.

²For the decade 1990–1999: the average for the years in which the given state existed.

Source: own calculations based on FAOSTAT, n.d.

¹Cypr i Malta zostały pominięte ze względu na niewielką rolę rolnictwa w tych krajach.

²W latach 1990–1999: podano średnią z tych lat.

Źródło: obliczenia własne na podstawie danych FAOSTAT, b.d.

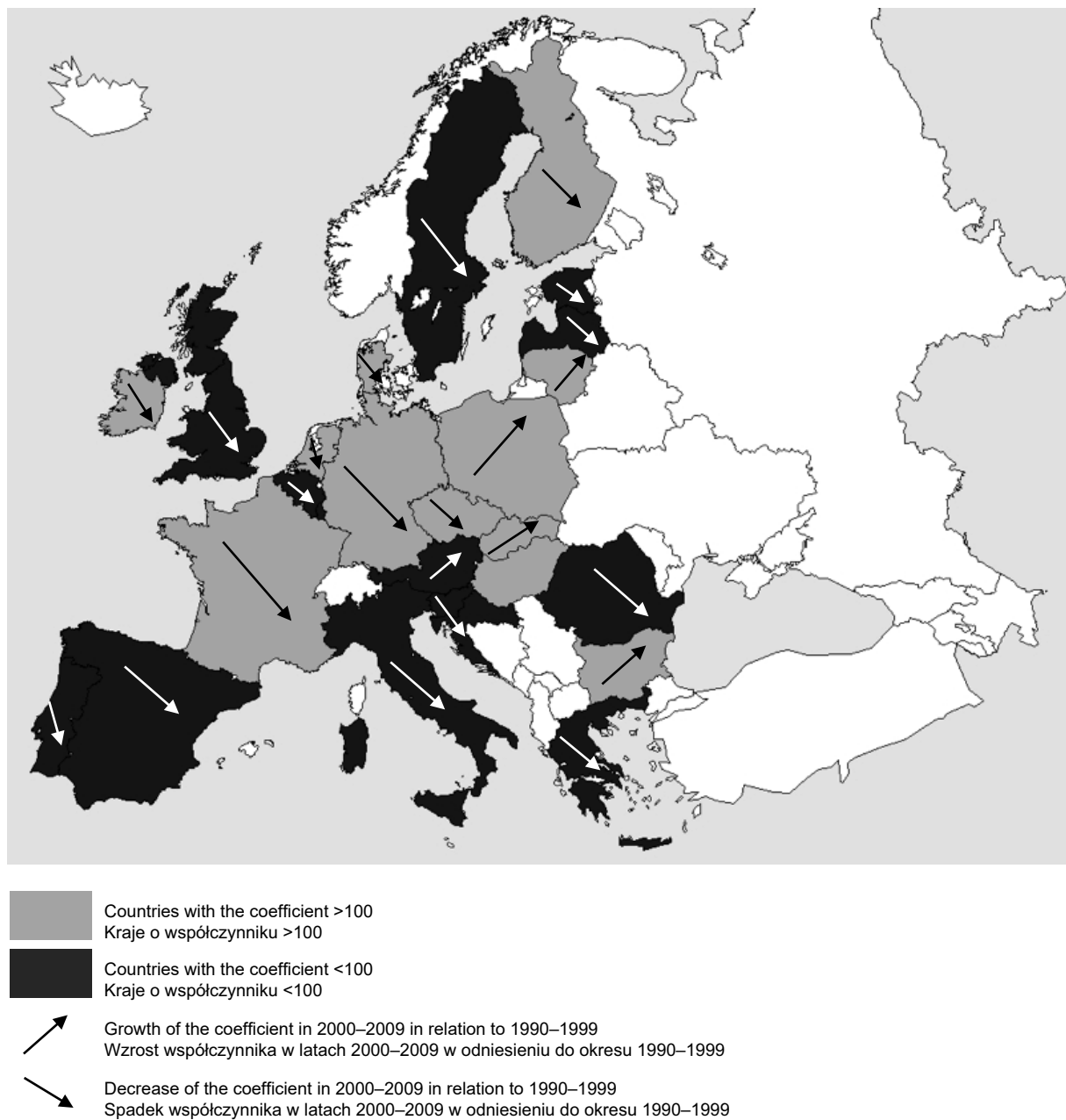


Fig. 1. European Union countries according to the coefficient of energetic food self-sufficiency in 2000–2009

Source: own elaboration based on FAOSTAT, n.d.

Rys. 1. Kraje Unii Europejskiej według współczynnika energetycznej samowystarczalności żywnościowej w latach 2000–2009

Źródło: opracowanie własne na podstawie danych FAOSTAT, b.d.

and hence on the decrease in production volume mainly in the old member states. Exemplary measures are free and obligatory set-aside and agri-environmental

programs started by the Mac Sharry's reform and tying in direct payments with the cross compliance standards since the Luxembourg reform in 2003. It can be noticed

that the above mentioned CAP implementations directly concern crop production. The point is that the European Union self-sufficiency and energy generation possibilities have been gradually decreasing when referring to it. Thus, such a far-reaching extensification can raise some objections, even when we consider the affluence of the European Union countries enabling them to agri-food import.

The food self-sufficiency phenomenon must be recognized as a part of the broader context of food issues because it concerns both energy and environment. Referring to the first one, import of the missing agricultural products by the affluent European Union's results in limited alimentation opportunities in other parts of the world (comp. Noleppa et al., 2013). The ecological viewpoint indicates that European energy shortage supplements will be generated in other parts of the world, including the areas valuable on a global scale.

The decrease in the coefficient level in the EU has been reflected in most of its member states. The increase in energetic food safety occurred in only five of them. Apart from Austria, where the level is still higher than 100, all of these are new member states. A separate analysis was carried out for 2004–2009 so as to investigate the last EU enlargements results in the context of the analysed energetic self-sufficiency phenomenon. In order for the study to be more evident, the same period of time was used for all the countries regardless their time of accession to the European Union. The analysis results indicate that the EU enlargement has caused only minor changes in the energetic self-sufficiency coefficient in this area. Undoubtedly, it is connected with the fact that among the basic agri-food products coming from the countries which joined the EU at the time, there were both countries of a complementary and competing character towards the EU-15 agricultural production. It is worth emphasizing that the complementary group consisted mainly of vegetable products while, in case of animal products, both in the group of old and new member states, there were market surpluses thus making them competing products.

In the post-accession period, the energetic self-sufficiency coefficient was higher than 100 in six of the eleven new member states. Besides, its value was each time higher in this group than in the whole 2000–2009 period. The only exception was Slovenia, where the value remained unchanged. It also refers to the EU-12 states, which are both net energy importers and exporters. Such

a direction and pace of changes of the studied phenomenon may indicate a varied impact of the accession. Two basic aspects are worth noticing. The first one is of economic character and concerns the possibility of functioning on the common European market and hence the necessity of competing with agricultural holdings from the EU-15. Taking agricultural backwardness of the post-communist countries into account, it was necessary to intensify a number of modernization activities in order to gain competitive advantage. Within the meaning of the present academic work, their result was an increase in the agriculture-generated energy amount in these countries. The second aspect refers to a specific, pro-developmental approach adopted by the majority of the new member states towards the CAP implementations, especially the financial resources coming from the second pillar of the CAP (Sadowski and Czubak, 2013). While in 2007–2013, the EU-12 states were mainly focused on the agricultural and food sectors modernization, the old member states allocated the EU funds for the issues connected with environmental protection or rural development. As a result, in 2004–2009 the new member states considered together were agricultural net energy exporters while the EU-15 members and the EU as a whole were its importers.

CONCLUSIONS

The level of food safety provision is much varied in the world, which often leads to considerable differences in the level of consumption and, as a consequence, is the main cause of malnutrition and hunger. In the case of high developed countries, the scale of this phenomenon is much lower. The research conducted concerned the European Union. In this area, there are mainly countries characterized by one of the highest levels of development with natural conditions supporting agricultural development.

However, some general conclusions can be drawn. It has been proved that the implementation of the food goal of agriculture depends mainly on natural conditions enhanced by anthropogenic factors. The first ones are essentially unchanging while the second ones, as being varied in their character, can either strengthen or weaken the impact of natural factors. What furthers achieving high food self-sufficiency are intense production processes, where financial capital and human resources responsible for scientific and technological

development are both needed. Economic motivation, connected with the need to become competitive, is also a favourable factor, which has been illustrated with the research example of the EU, chiefly by the majority of its new member states. The influence of politics is slightly different in this respect. In some circumstances it can build up self-sufficiency, as it had been before the Mac Sharry's reform, or restrain this process when overproduction occurs. The very difference in direction of politics ought not to be criticized as it is natural of each economic policy to correct spontaneous economic processes according to the present or future social needs resulting, for instance, from the necessity of environmental protection. Therefore, solutions such as agri-environmental or afforestation programmes or the application of cross-compliance standards seem to be right as a rule, especially as they were implemented in the situation of food overproduction and the deepening environmental degradation (Zegar, 2012). In the context of observed decrease in the food self-sufficiency of the EU and the majority of its member states, doubts may arise not mainly from the fact of pursuing pro-environment policy but from its present-day scope. Firstly, in case general self-sufficiency of the EU has been undermined, actions changing the state of things ought to be taken no matter if there exist any possibilities of filling in shortages with import because, in the long run, this can be a threat to the European societies food security. Secondly, excessive production extensification gives rise to ethical doubts in the context of world food issues (Paszowski, 2015; Sobczyński, 2015). Thirdly, and contrary to political intentions, the loss of self-sufficiency by the affluent Europe may not only fail to contribute to the environmental protection but in fact deepen the ecological problems worldwide if the additional amount of food, viewed as the amount of energy in this scientific description, is produced in the areas valuable from the environmental viewpoint.

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SAMOWYSTARCZALNOŚĆ ŻYWNOŚCIOWA KRAJÓW UNII EUROPEJSKIEJ – UJĘCIE ENERGETYCZNE

Streszczenie. Artykuł odnosi się do problematyki zaspokojenia podstawowej potrzeby społecznej, jaką jest wyżywienie. Głównym celem podjętych badań jest ocena energetycznej samowystarczalności żywnościowej oraz jej zmian w Unii Europejskiej ogółem i w poszczególnych krajach. Badania przeprowadzone zostały przy zastosowaniu autorskiej metodyki uwzględniającej ilość energii wytworzonej i skonsumowanej w latach 1990–2009. Jak wykazały przeprowadzone analizy, w badanym okresie Wspólnota stała się importerem netto energii zawartej w produktach rolnych. Nadwyżkę wytwarzanej energii odnotowują głównie państwa położone na niżu europejskim, przy czym w większości krajów, głównie UE-15, nastąpiło obniżenie analizowanego współczynnika w relacji do lat 1990–1999. Z kolei w nowych państwach członkowskich odnotowano wzrost energetycznej samowystarczalności żywnościowej. Wysłunięto wniosek, że o ile ogólnie samowystarczalność żywnościowa determinowana jest głównie czynnikami przyrodniczymi, o tyle na dynamikę w jej zakresie wpływają przede wszystkim czynniki związane z polityką rolną.

Słowa kluczowe: samowystarczalność żywnościowa, energia, Unia Europejska

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