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Globalization of the Market for Vegetable Protein Feed and Its Impact on Sustainable Agricultural Development and Food Security in EU Countries Illustrated by the Example of Poland

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Abstract: In recent years, food security—defined as the economic and physical availability of food—has become a topic of particular importance to European countries, including Poland. In the European Union, the production volume of protein raw materials has failed to meet the demand for many years now. The deficiency reaches 60–80% of protein raw material and is covered by imported goods, primarily including soya bean meal sourced from the Americas. This type of dependency could pose a threat to food security in Poland and in many other EU countries. The main purpose of this paper was to identify the condition of the market for vegetable protein feed around the world, in the EU and in Poland and to use the example of Poland to indicate the economic and environmental consequences of globalization processes affecting the feed industry. An attempt was also made to determine the impact of these processes on sustainable development and on self-sufficiency in vegetable proteins. As a source of information, this study relied on numeric data from databases delivered by the FAO, FEFAC, Alltech, Oil World, Central Statistical Office and the Institute of Agricultural and Food Economics—the National Research Institute. The study period was 2010–2018. The methodology proposed by Chechelski was used to assess the globalization process in the Polish feed industry. Primary data used to meet the objective defined above were retrieved from empirical studies carried out with 180 selected farms from all over the country and 74 feed factories. One of the conclusions is that the globalization process in the Polish market for vegetable protein feed resulted in changing the feed production technology by marginalizing the use of native sources of plant protein. As the farmers lack interest in cultivating these plants, they cannot reap the natural benefits derived from them. From the perspective of environmental impacts, this perturbs the sustainable agriculture concept.

Keywords: feed industry; protein security; soya; plant protein

1. Introduction

The future shape of the Common Agricultural Policy has been discussed for several years, both by politicians of the European Commission and by the scientific community. Undoubtedly, the overarching purpose of the CAP is to take measures that guarantee food security to EU member countries, including making them food sovereign. Food security was recognized as one of the key driving forces for the CAP reform towards 2020 [1]. Indeed, a strong agricultural sector is a condition for the development of a competitive agri-food industry which is a major part of the EU economy and trade [2,3].

Today, Poland and EU countries can be considered food-secure in economic terms. However, due to the economy being dependent on imports of vegetable proteins, there is a threat to food security

in physical terms. This is especially realistic in the case of a crisis in the Americas which are the main source of vegetable proteins. Therefore, a Multiannual Program called "Improving the domestic sources of vegetable protein and its production, trade system and use in feed" was implemented in Poland from 2011 to 2015 (the financing was provided by the Ministry of Agriculture and Rural Development). Since 2016, the second edition of this research program has been implemented, titled "Enhancing the use of domestic feed proteins in the production of high-quality animal products in a sustainable development perspective," to be completed in 2020. As part of the Program, research was undertaken to address some issues related to: protein crops farming in Poland; the relevant agricultural practices; the genetics of protein crops; and their suitability for feed production. A part of the research project was focused on the economic conditions for protein crops production in Poland. This included analyzing both the market infrastructure and the economic viability of using native protein crops in animal feed production. Emphasis was placed on assessing the trading system and the supplies of Polish protein raw materials to feed factories. The study also addressed the cost efficiency of plant breeding and the profitability of seed production in seed companies. Also covered was the commercial on-farm production of protein plant seeds. The last area included in the research plan was the animal feed industry segment as the final buyer of seed produced.

Hence, the objective of these measures was to create instruments that promote the reestablishment of native protein plants production and the development of the relevant market. The key issue is therefore to enable acquiring enough vegetable proteins for both food and feed while preserving the diversity of its sources.

Therefore, to contribute to the years-long discussion on a systemic approach to food security, considering the aspects of sustainable agricultural development, the authors of this paper want to share some findings from their research on the ability to increase the use of protein crops grown in Poland in the production of animal feed while following a sustainable development path for the Polish agriculture.

This paper focuses on two research goals: (1) to identify the condition of the market for vegetable protein feed around the world in the EU and in Poland; (2) to use the example of Poland to indicate the economic and environmental consequences of globalization processes affecting the feed industry. An attempt was also made to determine the impact of these processes on sustainable development and on self-sufficiency in vegetable proteins.

2. Literature Review

Food security, as a synonym for making food available to each human, is desirable irrespective of the political system and socioeconomic conditions. This is the overarching objective for each government.

The term "food security" itself is derived from military nomenclature and has been long used in a context of war operations or with reference to the economic and political dependence of countries unable to produce enough food by themselves [4]. Today's literature provides numerous definitions inspired by factors which include the volatility of food policies at both national and international levels [5]. The first official definition of food security was formulated at the 1974 Rome World Food Conference which concluded that "food security" means the availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices [6,7].

That concept was further modified to take account of the economic, rather than only physical, aspect of access to food. In the 1990s, it was enhanced with food safety considerations, nutritional qualities and food preferences depending on social and cultural factors [5]. Of the many definitions currently found in the literature, the one formulated in the 1996 FAO report is the most commonly cited [8]. It assumes that food security is met when "all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life" [9]. While the definition formulated above involves highly complex issues, the following three conditions are of fundamental importance [10]:

- Physical availability of food, which means a guarantee that the national economy can address at least the minimum physiological needs of the population. In this case, all imported food is above that minimum.
- Economic availability of food, which means that even the economically weakest households can afford food, including under food aid schemes.
- Food adequacy, which means that food is suitable for consumption in terms of health properties (absence of contamination) and the ration consumed (necessary amount of calories and proper nutritional value) [11]. As food security is defined at a general level, its measurement methods are ambiguous too [12], resulting in assessment problems. Also discussed is the problem of whether subsequent scenarios for changes in economic, environmental and political aspects should take account of the importance of sustainable development in preserving food [13,14].

However, when considering food security from the perspective of a single country, it is hard not to realize that the governments are the very ones who establish a political framework for this phenomenon. Indeed, the political conditions at national and global level (and the related ability to create regulations for food security and for the operating mechanisms of the food market) have an effect on what is referred to as the "food sovereignty" of a country [15].

In countries with a free market system, food sovereignty or food self-sufficiency means the economic and physical availability of food in the domestic market, irrespective of whether it was produced domestically or imported [16].

At the turn of the millennium, accelerating globalization processes combined with the internationalization of human activity resulted in highlighting many phenomena which can become a real threat to food sovereignty at all levels. This primarily includes trade liberalization, commercialization of food systems, urbanization, and changing eating habits. Another aspect is the growing world population, which drives an ever-increasing demand for food and feed. This is corroborated by World Bank forecasts which indicate that demand for food will increase by 50% until 2030; the corresponding growth rate for meat and meat products is 85% [17]. Meeting the necessary conditions for food security, as defined by FAO, is the essential and fundamental task of each government. However, from the perspective of sustainable agricultural development—and considering the commitment to make the country food sovereign—it is particularly important to make food physically available. That condition can only be met if the country is self-sufficient in native vegetable proteins which are used both for food purposes and as a basis for animal protein production. Hence, the key issue of what is referred to as "sustainable food security" is to have free access to resources of native vegetable proteins, i.e., to attain a condition which can be referred to as "protein security". This also involves a broader use of biodiversity in agriculture as it plays a major role in sustainable and more secure deliveries of food. Indeed, agricultural systems which rely on a wider spectrum of plant species are more resistant to climate conditions and to economic and political turmoil, thus improving food security [18]. Therefore, attaining a greater agricultural diversity is increasingly viewed as an important foundation of sustainable development [19].

On the one hand, the development of globalization processes in the food economy contributes to an increase in the global production, which can result in improved access to food. On the other hand, these processes can deteriorate food security, primarily due to a shift from sustainable agriculture towards industrialized agriculture: one where agricultural corporations oligopolize the global agribusiness space [20,21]. However, the particularity of globalization is that the underlying logic affects all aspects of life and each aspect can be described in terms of that logic [22]. The Polish feed industry is among the highly globalized sectors; the degree of globalization is measured with the share of global companies in sales revenues of the whole sector. It varies in the range of 30% to 60%. As a positive aspect of that process, highly globalized sectors have a statistically significant advantage over poorly globalized sectors as regards average remunerations, sales figures, labor productivity and the assets-to-labor ratio [23]. On the other hand, as a consequence of the globalization of the feed sector, the dominance of a few global corporations has contributed to a considerable reduction in the number of plant species

used as a source of proteins intended for animal feed, with only the most efficient being retained. As a result, genetically modified soya bean meal imported from the Americas contributes ca. 80% to feed production both in the EU and in Poland [24]. Native protein crop species (which have for decades been used in the production of feed, mostly for poultry and pigs) have been strongly marginalized while losing their economic importance. Nevertheless, the fundamental truth remains: the only secure food system is a sustainable system; and a commitment to sustainable development is the path towards food security [25,26]. Hence, some call for a more systemic approach to this problem and for the implementation of a sustainable framework of food security [27]. This means a framework which, rather than conventionally focusing on different components of the food system (e.g., supply and demand), would more comprehensively specify the complex relationships between such aspects as sustainable development or the "protein security" which is part of the food system of each country. The importance of that problem is evidenced by the fact that food security is linked to all Sustainable Development Goals (SDG) set by the United Nations. An improved management of food security based on strong, equitable and sustainable food systems which rely on state-of-the-art information technologies and sustainable equitable agricultural technologies, is of essential importance in order for national authorities to meet the goals of sustainable development [28].

3. Materials and Methods

The basic source of data for this study was information retrieved from databases of the Central Statistical Office, European Feed Manufacturers' Federation, Alltech, The Future of Food and Agriculture, Oil World and the Institute of Agricultural and Food Economics—the National Research Institute. The study period was 2010–2018. The globalization process of the Polish feed industry was assessed using a methodology proposed by Chechelski [23,29–31]. In this case, the share of sales revenue of transnational corporations in the market considered serves as basis for determining the globalization degree of a sector. This assumption was used to identify industries at various levels (degrees) of globalization, i.e., [32]:

- very high degree of globalization of the sector: the market share of transnational corporations is over 66%,
- high degree of globalization of the sector: the market share of transnational corporations varies in the range of 32% to 66%,
- low degree of globalization of the sector: the market share of transnational corporations is below 32%.

Primary data used to meet the objective defined above were from empirical studies carried out with 180 selected farms from all over the country and 74 feed factories. The survey was conducted in 2017 and 2018. A purposeful sampling approach was used. This study focused on legume farms located all over the country who had declared to be engaged in sales of commercially grown legumes in previous years and farms provided with a crop-specific payment per hectare of land under legumes and small-seed fabaceous plants as main crops. This study also required that consent be obtained from the farmers in order to survey their farms. As an additional criterion, the minimum area of agricultural land was set at 10 ha. The study covered 180 farms, including 55% of small farms (up to 50 ha), barely 15% of farms with an area of 50–100 ha, and 30% of farms with an area above 100 ha. The criterion for selecting feed producers was their size, measured as the number of employees (based on data provided by the Central Statistical Office). As a consequence, the study covered 74 feed production plants with no less than 10 employees (in 2017, this was 85% of all feed production companies with more than 10 employees). The study used a direct interview method based on a standardized survey questionnaire. The questions were formulated with the use of the rank scale and the Likert scale. This research also relied on unpublished financial data from 2003–2017 financial statements of feeding stuffs producers, as delivered by the Central Statistical Office. Descriptive statistics measures were used in the calculations and the results were illustrated with graphical methods for data presentation.

4. Results and Discussion

4.1. The Market for Vegetable Protein Feed around the World and in the European Union

According to demographic forecasts, the world population will grow by 30% from 2016 to 2050. The African population is expected to more than double. In America and Asia, the growth rate will be 20% (vs. 40% for Oceania). Europe is the only part of the world where the population is forecasted to decline by 3% [33,34]. Considering the above forecasts, an assumption must also be made that demand for vegetable proteins will grow. Indeed, the increasing world population drives greater demand for animal proteins whose production requirements mostly include the delivery of liquid vegetable protein to be used for feed. The development of the market for vegetable protein feed is mainly related to a growth in poultry production and to the progressing intensification of milk production and pig breeding. As the animal production efficiency is on the rise, the demand for protein raw materials used in feed keeps increasing. The European Union has a small market for native vegetable protein raw materials: the cultivation of protein crops accounts for only 3% of arable land. Over 75% of demand for vegetable proteins is met with soya bean meal and soya beans imported mainly from the U.S. and South America. Currently, the European Union imports 26 million tons of soya bean meal and 15.9 million tons of soya beans each year [35]. Such a great dependence of many Community countries on imported vegetable proteins poses a threat to their sovereignty in that respect. This is all the more important since the imports of these raw materials have followed an upward trend in recent years (Figure 1).

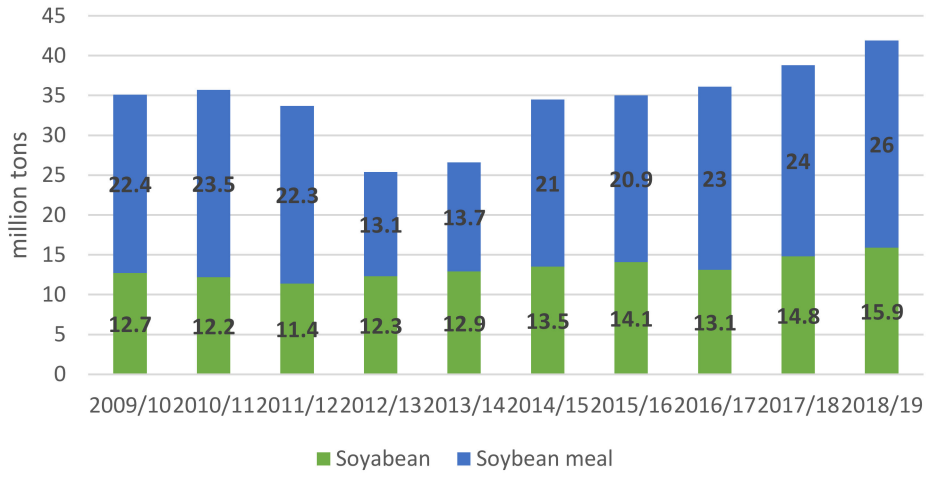

Figure 1. Imports of soya beans and soya bean meal into the European Union in the period 2009/2010–2018/2019 (million tons). Source: own elaboration based on [35,36].

The increasing demand for soya bean meal results from increased demand for food. This, in turn, drives a consistent increase in industrial feed production; thus, the demand for vegetable proteins grows. According to Alltech data [37], the global production volume of industrial feed in 2018 was 1103 million tons, which is 15% more than in 2012 (Table 1).

An increase in the production volume of industrial feed was experienced all around the world (Table 1). In the study period, the greatest production figures were recorded in Asia (over 394 million tons), followed by Europe (277 million tons) and North America (198 million tons). Similarly to the previous year, China remained the world's leading producer of industrial feed [38]. In 2018, 188 million tons of feed were produced in China, which is 1 million tons more than in the previous year. China saw its feed production volume more than triple over the last decade [39]. Other major producers in the Far East are Japan (24 million tons), South Korea (20 million tons), Thailand (21 million tons) and Indonesia (20 million tons).

Table 1. Production of industrial feed by region in 2012–2018 (million tons).

Specification	2012	2013	2014	2015	2016	2017	2018
Africa	30.3	31	34.6	36.1	39.5	39.1	40.6
Asia	365.5	348	350.5	350.4	367.6	381.1	394.9
Europe	208.4	226.9	232.6	240.6	249.4	267.1	277.1
Latin America	137	142	144.8	152.3	157.5	160.7	164.4
Middle East	25..4	26	24.8	22.1	27.1	24	26.6
North America	188.1	189	182.8	194.1	191.1	194.6	198.0
Total	954.7	962.9	970.1	995.6	1032.2	1066.6	1102.5

Source: own elaboration based on [37].

According to FEFAC [40], the production volume of industrial feed in EU-28 member countries in 2018 was 161.3 million tons, which is 1.32% more than in 2017. Moreover, there was a relative increase in the demand for vegetable proteins.

The production of industrial feed is mostly concentrated in UE-15 countries (ca. 85%), with a total volume of 131.8 million tons in 2018. Germany, Spain and France have been the UE-28's leading producers for many years now (Figure 2).

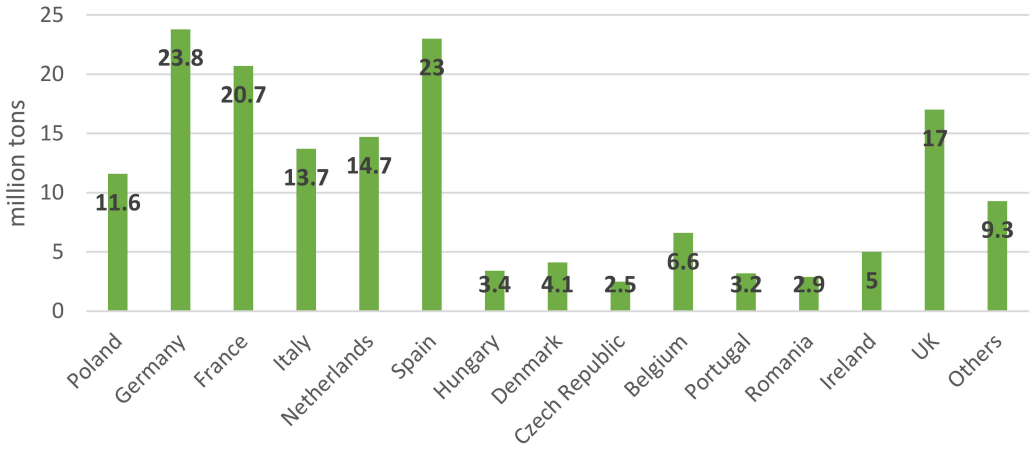

Figure 2. Production of industrial feed in EU countries in 2018 (million tons). Source: own elaboration based on [40].

In 2018, their production volume of industrial feed was 23.8, 23.0 and 20.7 million tons, respectively. Other major EU producers are the United Kingdom (17 million tons), the Netherlands (14.7 million tons), Italy (13.7) and Poland (11.6).Similarly to previous years, poultry feed (34%, on average), pig feed (32.6%) and cattle feed (27.4%) (Figure 3).

Feed grains (ca. 50%) and oilseed meal, including soya bean meal (ca. 30%), are the main source of proteins for the production of feed raw materials in the European Union (Figure 4). Native legumes—which are important from the perspective of meeting the demand for products with a high protein content and can be used as an ingredient in feed production (pea, lupine, chickpea, lentils)—are of marginal importance as they account for barely 2% of all plants used in feed production [40,41] (Figure 4).

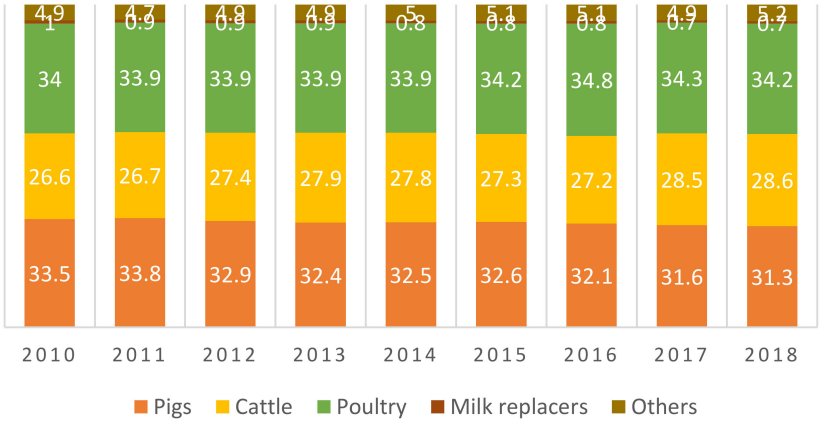

Figure 3. Feed production mix in the EU-28 in 2010–2018 (%). Source: own elaboration based on [40,41].

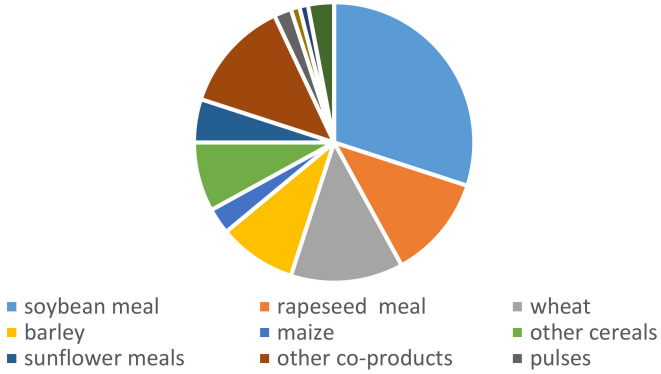

Figure 4. Sources of proteins for feed use in the EU-28 in 2017/2018 (%). Source: own elaboration based on [40,41].

In the European Union, the index of self-sufficiency in vegetable proteins is ca. 60% (Figure 5) and differs in function of the source of proteins (79% for rapeseed, 42% for sunflower, 5% for soya beans). As a consequence, the EU imports ca. 17 million tons of raw proteins each year, including 13 million tons of soya proteins which corresponds to 30 million tons expressed in terms of soya bean equivalent [42]. Therefore, member countries are dependent on soya bean imports from the U.S. and South America.

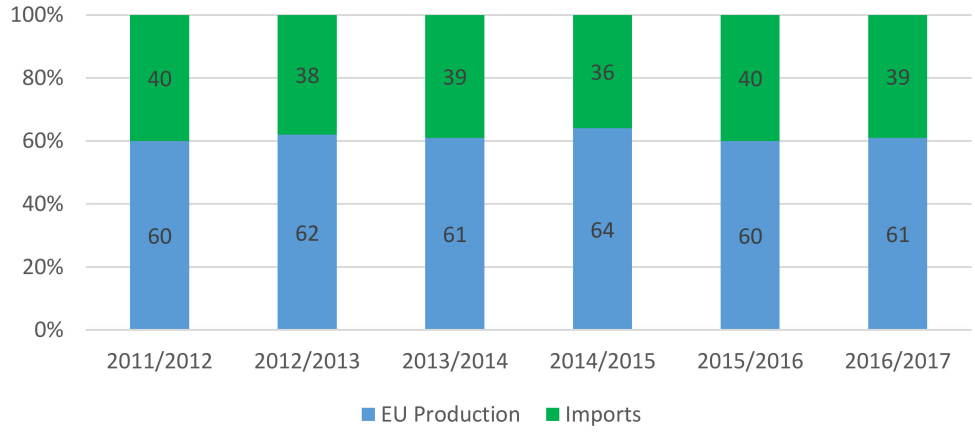

Figure 5. Net trade in proteins in the European Union in 2011/2012–2016/2017. Source: own elaboration based on [40,41].

In 2018, global sales of soya beans totaled USD 59.3 billion [43]. Latin America (63% of global exports), Mexico excluded, sold USD 37.3 billion worth of soya beans in 2018. According to previous analyses of the Institute of Agricultural Economics [44], in 2018/2019, member countries purchased over 2.8 million tons of soya beans, thus transferring nearly one milliard (987 million) euro to non-European suppliers.

4.2. Economic Consequences of the Globalization Process in the Polish Feed Market

Similarly to other European Union countries, Poland has an index of self-sufficiency in vegetable proteins at a level of only 30% of total demand. The remaining part is supplemented with soya bean meal imported from the Americas.

In the 2017/2018 season, Poland imported over 2.4 million tons of soya bean meal (27% more than in the 2011/2012 season) and 106.2 thousand tons of soya beans (950% more than in the 2011/2012 season) (Figure 6). The above findings support the opinion that animal feed production strongly depends on imports of soya bean meal, originating mainly from the Americas.

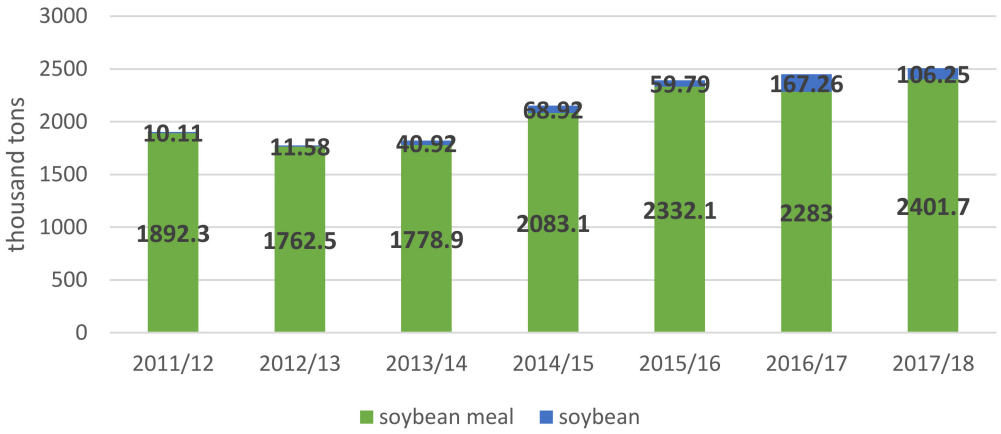

Figure 6. Imports of soya bean meal and soya bean into Poland in 2011–2018 (thousand tons). Source: own elaboration based [45].

International companies started to emerge in the Polish feed market in 1990. During the next 15 years, they increased their market share by taking over subsequent Polish feed factories, mostly medium-sized (up to 250 employees). As a consequence, a total of 105 to 118 feed factories were operating in the 2010–2017 period.

As regards the number of operators, this group is dominated by small factories (up to 50 employees). Many of them are part of domestically invested undertakings with many branches. In 2016, they accounted for more than 69% of all operators active in this industry. Medium-sized feed factories had a share of 27%; the largest ones (international corporations) represented only 4% of all feed factories in Poland.

The progress in globalization of the Polish feed industry was analyzed using a methodology proposed by Chechelski [29]. In this case, the share of sales revenue of transnational corporations in the market considered serves as basis for determining the globalization degree of a sector.

The analysis of sales revenue (until 2015) of the four largest transnational corporations active in the Polish feed industry found that the revenue followed a steady upward trend. In 2003, their share in income was 31.8%, reaching 32.1% already in 2005 and 49.5% in 2010. Finally, in 2015, they attained a majority share of 51.3% in the feed market [31]. The above is also confirmed by findings from research carried out in 2011–2017 under the Multiannual Program of the Ministry of Agriculture and Rural Development which established that the share of large transnational corporations in the Polish feed market leveled off at 52.6% in 2016 and 55.3% in 2017. In accordance with the methodology used in this study, it may be concluded that the Polish feed market is at a medium level of globalization. In

turn, medium-sized domestic factories had a 35% share in total feed sales revenue, whereas the share of the numerous small operators was only 12% [46].

The reconstruction of the domestic market for native protein crops, if possible, would require financial expenditure from feed entrepreneurs. Hence, an analysis was carried out of the financial situation of operators owned by transnational corporations active in the Polish feed market. The financial condition of these undertakings was found to be satisfactory, as reflected by the synthetic indicator of profitability, which was 0.638 in 2015, compared to the average level of 0.585 for the whole Polish food industry [47]. In 1H 2019, animal feed producers recorded a net revenue from product sales of PLN 8.55 billion, i.e., 2.7% more than in 1H 2018. This accounted for 6.8% of revenues of the agri-food sector. However, in view of the readily available resources of imported soya bean meal with high-quality protein content and due to good market organization, they were not interested in increasing the use of native vegetable proteins. This is especially the case since high-production fragmentation is characteristic of that market and requires additional expenditure to be incurred to organize the buying-in process [48]. Of the producers surveyed, 60% claimed not to use any native legumes in feed production at all. A total of 24% of respondents declared that the share of native legumes was 2% to 10%; in 16%, it was above 10%.

The changes in ownership of feed factories also involved a shift towards more efficient technologies which are unified in terms of quality across the corporation. As a result, the sources of native vegetable proteins previously used in factories taken over became increasingly replaced with ones preferred by corporate management. As a consequence, as the transnational corporations increased their share in the Polish feed market, the demand for native sources of proteins (mainly including legumes) declined. Proteins derived from imported soya bean meal came as a replacement. This was reflected in the area of land under legumes in Poland which nearly halved between 1990 and 2017. The largest area of legume crops (450,000 ha of arable land) was recorded in 1988. At that time, it was the basic source of vegetable proteins which made the country self-sufficient in that respect. The introduction of soya bean meal to the Polish feed market in early 1990s resulted in the native sources of proteins being gradually replaced with soya proteins. As a consequence, native protein resources became marginalized for many years. In 2002, the area of legume crops was only 64,000 ha.

As shown by the analysis, following the sharp decline in production volumes witnessed in the 1990s, the area under legumes has been observed to increase slowly in recent times. However, rather than being caused by increased demand from feed factories, this is the outcome of intervention policies by the Polish government and the EU who offer payments for legume cropping [49].

As a consequence of these measures, the area under legumes followed an upward trend, reaching 120,000 ha in 2009, and increasing to 272,000 ha in 2017. This was especially true for fodder plants which currently make up ca. 75% of area under legume crops. In the total cropping mix in 2018, it was barely 2.5%, compared to 72.1% for cereals [50].

4.3. Economic Consequences of the Globalization Process in the Polish Feed Market

In recent years, crop producers have been more and more interested in making rational use of the natural environment. Legume cropping plays a significant role in sustainable farming [51]. Legumes are highly valued mainly because of their beneficial impact on soil fertility. In addition to nitrogen, they enhance the soil with organic matter in the form of crop residue rich in macro- and microelements, thus improving its fertility and physical properties. By increasing the levels of humus, they enhance the soil's sorption capacity which prevents nutrients from being leached into deeper soil layers. Moreover, they restrict the development of cereal pests and diseases. They play an important role in crop rotation by breaking the common pattern of cereals sown after each other. They contribute to higher yields of subsequent crops, especially rape and cereals. [52–55]. Introducing legume crops into crop rotation once every four years results in a significant drop in CO_2 emissions [56]. Because of the natural and biological values discussed above, legume cropping plays an important role in the sustainable agriculture concept from the perspective of its environmental impacts.

In a survey carried out in 2011–2017 under the Multiannual Program, a selected group of farmers were asked to identify three key factors which prompted their decision to engage in legume farming (Figure 7) (1: the most important factor, 2: the second most important factor, 3: the third most important factor).

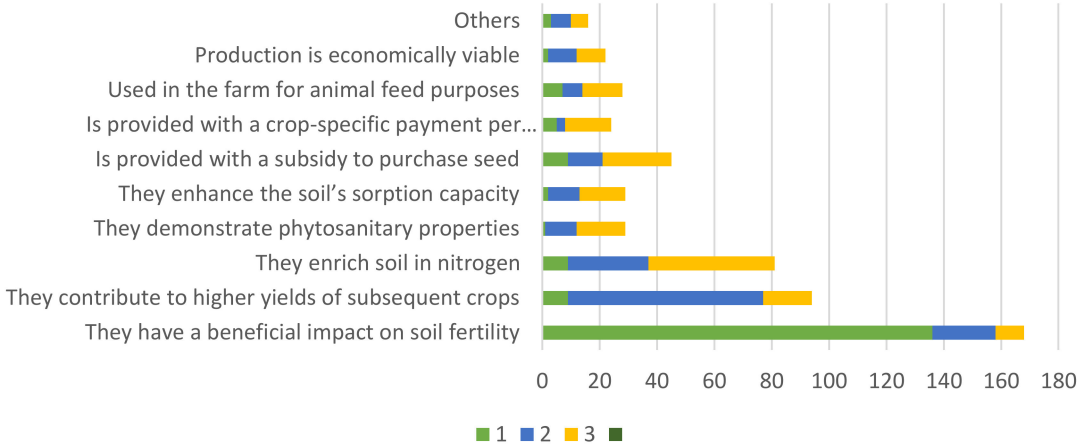

Figure 7. Key factors behind the farms' decision to engage in legume cropping (n = 180) 1—the most important factor, 2—the second most important factor, 3—the third most important factor. Source: own study based on the questionnaire survey.

Most interviewees indicated factors that improve soil texture and the impact of legumes on increased yields of subsequent crops as the decisive reasons for legume cropping (Figure 7). Another reply was the improved nitrogen balance in the soil and, as a consequence, a reduction in the quantities of nitrogen-based mineral fertilizers purchased [53]. However, these plants were not identified as an important resource of proteins for feed production. This can be primarily explained by the lack of demand for legumes from feed factories which process imported soya bean meal.

5. Conclusions

According to demographic forecasts, the world population will grow by 30% until 2050, and therefore the demand for vegetable proteins can be reasonably expected to increase. Indeed, the increasing world population drives greater demand for animal proteins whose production requirements mostly include the delivery of liquid vegetable protein to be used for feed.

According to the Chechelski index, the Polish animal feed industry is at an average level of globalization (51.3% in 2015; 52.6% in 2016; 55.3% in 2017). This resulted in a situation where the domestic demand for vegetable proteins is 70% covered by soybean proteins imported from the Americas. As a consequence, the feed production technology was changed by marginalizing the use of native sources of plant protein. This made Poland and many EU countries dependent on imports of vegetable protein resources, which puts their food sovereignty at risk.

Due to lack of demand for native protein crops from transnational corporations who hold a dominant share in the Polish animal feed market (in 2017, their share in income was 55.3%), the farmers lack interest in cultivating these plants. Thus, they cannot reap the natural benefits derived from them. From the perspective of environmental impacts, this perturbs the sustainable agriculture concept.

In Poland, as a consequence of measures taken, the area under legumes followed an upward trend, reaching 120,000 ha in 2009, and increasing to 272,000 ha in 2017. This was especially true for fodder plants which currently make up ca. 75% of area under legume crops. However, in the total cropping mix in 2018, it was barely 2.5%; from the perspective of secure deliveries of vegetable proteins, this is highly insufficient. Note that in Poland, the corresponding share for cereals was 72.1%.

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