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Agrarian processing industry as a guarantor of food security in the region

Abstract. The article singles out various clusters of EU geopolitical subjects for food production. The research touches upon the ranking carried out on the basis of the share of processed goods in the structure of the EU, which makes it possible to assess the contribution to ensuring the food security of the members of the Union. Seven indicators of the production of processed goods in 2016 were selected for the current analysis. As a result, the authors of the article have identified and analysed geopolitical subjects that determine the stability of the EU agricultural production, namely the Netherlands, Poland, Spain, Ireland, Austria, Belgium, Finland, Romania, the Czech Republic, Bulgaria, Sweden and others. It has been noted that opportunities for industrial cooperation and development of coordinated policies on various areas of interaction are increasing within the framework of the associations.

Keywords: Agrarian Industry; Agrarian Processing Industry; European Union; Cluster Analysis; Food Production; Food Security

JEL Classification: Q13; Q18; O13; O19

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Аграрна переробна промисловість як гарант забезпечення продовольчої безпеки регіону

Анотація. У роботі викладено кластери геополітичних суб'єктів ЄС з виробництва продуктів харчування. Проведене ранжування, в основу якого покладено частку виробленої товарної продукції в структурі ЄС, дозволяє оцінити внесок у забезпечення продовольчої безпеки членів союзу. У результаті дослідження було виокремлено геополітичні суб'єкти, що визначають стабільність аграрного виробництва ЄС. Визначено, що в рамках об'єднань збільшуються можливості для промислової кооперації та вироблення узгодженої політики з різних напрямків взаємодії.

Ключові слова: аграрна промисловість; Європейський Союз; кластерний аналіз; виробництво харчових продуктів; продовольча безпека.

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Аграрная перерабатывающая промышленность как гарант обеспечения продовольственной безопасности региона

Аннотация. В работе выделены кластеры геополитических субъектов ЕС по производству продуктов питания. Проведенное ранжирование на основании долей производимой товарной продукции в структуре ЕС позволяет оценить вклад в обеспечение продовольственной безопасности членов союза. В результате выделены геополитические субъекты, определяющие стабильность аграрного производства ЕС. Отмечается, что в рамках объединений увеличиваются возможности для промышленной кооперации и выработки согласованной политики по различным направлениям взаимодействия.

Ключевые слова: аграрная промышленность; Европейский союз; кластерный анализ; производство пищевых продуктов; продовольственная безопасность.

1. Introduction

The processing industry is a socially important industry in the provision of food products, determining the standard of living of the population, the volume of food production, their quality, price and range.

In connection with the formation of the «Sustainable Development Goals» until 2030 by the world community, the study of food security factors that determine economic policies is becoming an increasingly discussed topic and requires topical solutions.

2. Brief Literature Review

The issues of food security have been studied in the framework of works by D. Vamvuka, M. Trikouvertis, D. Pentari, G. Alevizos, A. Stratakis [1]; M. P. Yadav, M. S. Kale, K. B. Hicks, K. Hanah [2]; A. Đokić, S. Jović [3].

A. Moragues-Faus, R. Sonnino, T. Marsden [4] have studied the vulnerability of the European food system and integrated food safety management. K. McNeill, K. Macdonald, A. Singh, A. D. Binns have analyzed integrated food and water safety modeling platforms [5].

G. Schouten, M. Vink, S. Vellema, S. R. Araujo-Enciso, Th. Fellmann, O. V. Svyatova, D. A. Zyukin, R. V. Soloshenko and O. N. Vydrinadevoted their research to the study of food supply in various regions of the world [6; 7; 8]. L. N. Borisoglebskaya, O. V. Kudina, E. S. Dibraeva [9], L. Vinnichek and L. Tretyak [10] have carried out modelling of stability of the development of geopolitical subjects.

The external economic orientation of the state in the field of food security in the world community is to effectively implement the international division of labour while avoiding a critical dependence on food imports.

Beginning in 2004, it became obvious that in the conditions of agri-food crises arising from adverse natural phenomena, of which no state is insured, the solution of food security problems is possible only by coordinating the policies of states and uniting efforts at the world level. The importance of the concept of forming an integrated agri-food market is growing. In this regard, the issues of maintaining the position of the national producer in the market lose significance. However, the states, when supporting the national producer, have an opportunity to preserve its competitiveness in the world market.

3. Purpose

In this connection, it seems necessary to study the experience relating to interaction between members of integration associations, the development of national economies and the agricultural sector. The European Union is considered to be the most developed integration grouping in the world.

4. Results

The European Union is currently seeking to observe the principles of good neighborliness, paying attention to food security, sustainable production and development of rural areas. Predominantly rural areas account for 57% of the territory of the European Union, which is home to 27% of the population. In countries such as Ireland, Greece, Portugal and Finland, more than 80% of the territory is rural. In Ireland, 60% of GDP is provided by agriculture.

The dynamic agriculture of the EU is characterized by constant quantitative and qualitative changes in the territorial organization and structure of production. This allows us to talk about the relevance of the study of the territorial differentiation of agriculture on the geopolitical subjects of the EU.

The study uses cluster analysis to group the countries of the European Union in terms of the production of a number of food products. The ranking of the contribution to food security will be assessed by the share of manufactured goods in the EU structure. Thus, we will be able to identify geopolitical subjects of the EU that determine the stability of agricultural production.

As the initial data, we have selected 7 indicators of the production in 2016. They are «Production of milk on farms, thousand tonnes», «Production of meat: cattle, thousand tonnes», «Production of meat: sheep and goats, thousand tonnes»; «Production of meat: poultry, thousand tonnes», «Production of meat: pigs, thousand tonnes»; «Fresh vegetables and strawberries / Area (cultivation / harvested / production) (1000 ha)»; «Oats and spring cereal mixtures / Harvested production (1000 t)». Statistical data in the context of 28 geopolitical subjects of the EU are placed in the catalogue of the consolidated data of the project TrendEconomy.ru available at http://data.trendeconomy.ru/dataviewer/eurostat/sd_ec_inn.

Using the method of hierarchical cluster analysis (Joining (tree clustering)), we will group the selected indicators characterizing the volumes of food production in the European Union. The distance of the far neighbour (Complete Linkage) is selected for cluster consolidation.

The results allow us to distinguish the presence of two groups of indicators with a similar production structure for the geopolitical subjects of the European Union (Figure 1). The first group includes indicators such as «Production of meat: cattle», «Production of meat: poultry». The second group includes three indicators, namely «Production of meat: sheep and goats», «Fresh vegetables and strawberries / Area (cultivation / harvested / production)», «Oats and spring cereal mixtures / Harvested production».

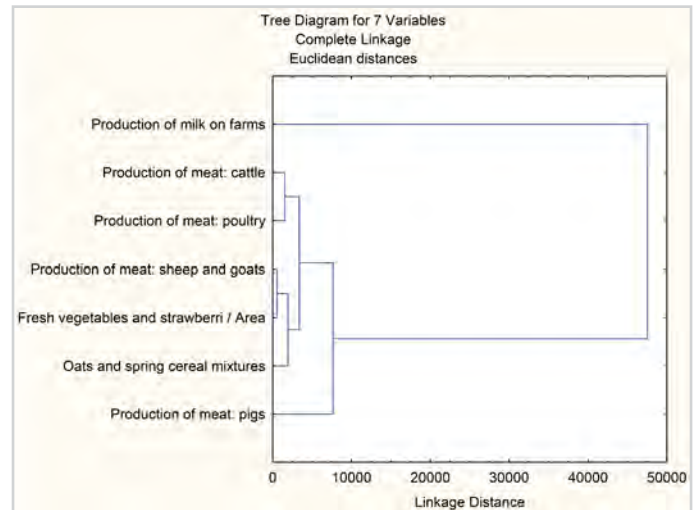


Fig. 1: Dendrogram of degree of difference in indicators of geopolitical subjects of the European Union

Source: Compiled by the authors based on data from the TrendEconomy.ru

(http://data.trendeconomy.ru/dataviewer/eurostat/sd_ec_inn)

The dendrogram makes it possible to note that the largest contribution to the grouping of the EU subjects for the selected indicators is made by the volume of milk produced on farms, and the production of pork.

The influence of the specialization of the production of sheep and goat meat on the subjects is comparable to the nature of the influence of the production of fresh vegetables and strawberries. In 2016, the EU subjects were slightly differentiated in the production of meat of cattle and poultry, which indicates the development of livestock and poultry in many subjects, as well as the practical self-sufficiency of the regions with regard to such products.

In most of the countries under consideration, livestock farming is developed. In this regard, a significant production of crops is focused on the production of feed. So in 2016, temporary grasses and pastures (Temporary grasses and grazings) occupied the territory of the European Union equal to 10,201.85 hectares. The value of the indicator decreased in relation to the previous year by 17.9%.

On the territory of the European Union, 26 subjects produce oats and mixtures of spring cereals. The largest volumes of production of these crops in 2016 were in Poland - 33.3%, Spain - 10.4%, Finland - 10%, Sweden - 7.7% and Germany - 5.41% of the total volume of the European Union.

The production of a number of agricultural crops, due to the peculiarities of the natural and climatic conditions, is of a local nature and the countries traditionally produce certain categories of products.

The calculations make it possible to single out milk production on farms and pork production as indicators reflecting the division of labor in the European Union. Leading positions in the production of pork in the EU are taken by producers from Germany, Spain and France. Their cumulative share of the total slaughter weight of produced pork in the EU is about 50%.

When grouping 28 geopolitical entities, the number of groups is chosen 5. Clusters are formed using the K-means clustering method. The obtained values of the statistics of the variability of the selected indicators for EU subjects confirm the importance of the allocation of milk production in the EU ($F = 262.71$), the production of cattle meat ($F = 50.28$). The P-value ($\text{signif. } p = 0$) reflects a zero probability of the error of the assertion (Table 1). The indicators «Production of meat: poultry» ($F = 12.40$) and «Production of meat: pigs» ($F = 12.52$) are significant for the grouping of EU subjects, the probability of errors in making the corresponding statements is $\text{signif. } p = 0.00002$.

The distribution of subjects across the clusters is based on selected indicators in 2016. To assess the homogeneity of the cluster structure for each geopolitical subject, the distance from the respective cluster is indicated in parentheses.

Tab. 1: Analysis of Variance

Variable	Between SS	df	Within SS	df	F	signif. p
Production of milk on farms, 1000 t	1.701781E+09	4	37246860	23	262.71	0.00000
Production of meat: cattle, thousand tonnes	3.716320E+06	4	425023	23	50.28	0.00000
Production of meat: sheep and goats, thousand tonnes	2.445929E+04	4	69675	23	2.02	0.12533
Production of meat: poultry, thousand tonnes	7.754684E+06	4	3596481	23	12.40	0.00002
Production of meat: pigs, thousand tonnes	3.246050E+07	4	14911300	23	12.52	0.00002
Fresh vegetables and strawberry / Area (cultivation/ harvested /production) (1000 ha)	1.606885E+05	4	199473	23	4.63	0.00686
Oats and spring cereal mixtures / Harvested production (1000 t)	3.702655E+06	4	9695498	23	2.20	0.10128

Source: Compiled by the authors

Members of Cluster Number 1 Centre Cluster contain 2 cases. France (1393.68) and Germany (1393.68). These geopolitical subjects accordingly produced the following shares: 16.2% and 20.2% of total amount of milk; 18.7% and 14.7% of cattle meat (cattle); 12.7% and 11.6% of poultry meat; 9.3% and 23.7% of pork; 11.08% and 5.88% of fresh vegetables and strawberries; 5.2% and 5.4% of oats and mixtures of spring cereals. France, fully providing itself with the main types of agricultural products, is a major exporter of wheat and sugar.

Members of Cluster Number 2 Centre Cluster contain 4 cases: Italy (556.22); United Kingdom (527.67); Netherlands (606.02); Poland (998.47), the agrarian industry of which works to meet their needs in the food products in question and exports surpluses to the foreign market.

Distances from the respective cluster reflect that Italy and the United Kingdom constitute the centre of the cluster under consideration. In 2016, these subjects produced the following shares from their total EU production: 7.85% and 9.25% of milk; 10.38% and 11.69% of cattle meat; 4.41% and 38.86% of sheep and goat meat; 10.38% and 13.60% of poultry meat; 6.55% and 3.90% of pork, respectively. Also, significant are the shares of the subject's production of fresh vegetables and strawberries - 19.48% and 5.18%, oats and mixtures of spring cereals - 2.42% and 7.59%, respectively.

The agrarian industry in the Netherlands is highly productive. Dairy products, pork, poultry, eggs, canned meat are produced for export. The share of livestock production is about 70%. The stock in 2016 was 4.2 million of cattle and 11.9 million of pigs. The Netherlands is one of the world leaders in the production of meat and food by-products of poultry, with its USD 0.67 billion or 10.9% of world exports. The country produces the following food products in the structure of the EU production: 8.85% of milk; 5.33% of cattle meat; 1.92% of sheep and goat meat; 6.17% of pork; 4.0% of fresh vegetables and strawberries. Vegetables and fruits, flowers and flower bulbs are grown for export all year round.

Poland is the EU leader in the production of oats and a mixture of spring cereals - 33.27%. The share of fresh vegetables and strawberry production is also significant - 10.81%. Grain crops occupy 56% of the area of the country's agricultural land, with 18% for fodder, 16% for potatoes, 5% for technical crops and 5% for vegetable crops.

In terms of livestock, the country breeding has developed pig farming (11.6 million livestock) and cattle breeding (6 million of cattle). In 2016, Poland exported meat and poultry by-products amounting to USD 0.5 billion or 8.17% of world exports. The country's shares of production of food products in the EU structure are 8.21% for milk; 6.43% for cattle meat; 17.22% for poultry meat; 8.33% for pork.

Members of Cluster Number 3 Centre Cluster contain 3 cases: Denmark (509.35); Ireland (724.42) and Spain (1121.60). Denmark is one of the most efficient economies in the EU, ranking first in the world in terms of foreign trade per capita. Spain is the second largest area in the EU, with France being the first. Ireland exports 90% of the country's butter, 25% of cheese and 80% of beef, however it imports about 50% of crop production. The countries have similar production volumes by the studied indicators.

Denmark enjoys a high degree of self-sufficiency in food products among the EU subjects. The cattle stock in Denmark

is 1.55 million. Denmark outstrips the production of milk (5.4 million tons in 2016), if compared with Austria, Belgium, Portugal, Sweden and Finland. Its shares of production of food products in the EU structure are 3.37% for milk; 1.65% for cattle meat; 0.21% for sheep and goat meat; 1.10% for poultry meat; 6.64% for pork; 0.54% for fresh

vegetables and strawberries and 2.81% for oats and spring mixtures of cereals. More than 2/3 of the country's food products are exported: pork, poultry, cheeses and animal fats. However, attention in foreign trade is gradually shifting towards the export of manufactured goods.

Animal husbandry plays a leading role in Ireland's agriculture: over 70% of all products are exported. The country's pastures occupy more than 2 million hectares; its cattle stock is 6.6 million, and the stock of sheep is 3.4 million. Ireland is the largest supplier of meat and milk in Europe, with its 4% for the share of milk production; 7.54% for the share of cattle meat production; 8.16% for the share of sheep and goat meat; 1.16% for the share of poultry meat production and 1.19% for the share of pork production.

In Spain, the number of cattle in 2016 was 6.3 million, while the number of sheep was 16 million heads. The country's own livestock products account for 90% of the Spanish market. Spain is the third wine producer in the world, the fourth world producer of citrus fruit. It also provides one quarter of world production of olives and olive oil. The country's shares of food products in the EU structure are 5.08% for milk; 8.17% for cattle meat; 17.02% for sheep and goat meat; 11.59% for poultry meat and 17.74% for pork. Also, the share of fresh vegetables and strawberries production was 16.98%; the share of oats and spring mixtures of cereals was 10.43%.

Members of Cluster Number 4 Centre Cluster contain 6 cases: Austria (182.25); Belgium (350.96); Czech Republic (198.82); Finland (461.97); Romania (445.93); Sweden (276.315). This group includes industrial countries, in which industry and the extractive industry prevail over agriculture in the economy.

In Austria, the sown areas occupy 4.1 million hectares (about one half of the country's area). Dairy farming is the basis of the country's agriculture, which amounts to 2.26% of milk in terms of the total value of the EU milk production. Viticulture, cereal production, pig production and fruit growing are also well developed. The share of meat production in the structure of the EU is 0.14% for cattle meat and 0.32% for pork.

In Belgium, agriculture is very intensive. The production of certain types of food (vegetables, eggs, meat, milk and butter) exceeds the needs of the country. The number of cattle is over 2.5 million, pigs - 6.2 million head, according to data for 2016. The shares of production of food products in Belgium in the EU structure are 2.43% for milk; 3.56% for cattle meat; 0.40% for sheep and goat meat; 3.50% for poultry meat; 4.50% for pork; 2.74% for fresh vegetables and strawberries and 0.15% for oats and spring mixtures of cereals. Belgium fully satisfies its domestic demand for livestock products, partly exporting them. However, about 20% of the necessary crop production is forced to import (cereals, feed, etc.).

The Czech Republic is an industrial country. The share of the country's agriculture continues to decline. Among the traditional agricultural products we can single out grain, potatoes, sugar beets, grapes (table and wine varieties) and fruits. Sugar production and brewing are well developed. Pigs (1.5 million), sheep (1.4 million) and poultry are settled to meet local needs. The country's shares of production of food products in the EU structure are 1.90% for milk; 0.92% for cattle meat; 1.19% for poultry meat; 0.94% for pork; 0.48% for fresh vegetables and strawberries and 1.32% for oats and spring mixtures of cereals.

Finland belongs to one of the northernmost agrarian countries. The main directions of the country's agriculture are livestock and dairy products. The share of milk production is 1.51% in the EU structure; cattle meat - 1.11%; poultry meat - 0.95%; pork - 0.81%; fresh vegetables - 0.78%, and oats and spring mixtures of cereals - 9.97%. Own livestock products account for 100% of the Finnish market.

Plant products in Finland are tomatoes, strawberries, currants and peas. Potato production has a significant share in the exports of Finland's agricultural products. The agriculture in Finland is highly technological and intensive, being closely linked with the country's processing industry.

Romania is a major producer of crops, which covers the country's main domestic demand and is partly exported. The livestock in Romania accounts for about 1/3 of the country's gross agricultural output. Romania has an agricultural potential of about 14.7 million hectares, of which only 10 million hectares are used as arable land. In the country, low-intensive pasture livestock is widely distributed, which is characterized by relatively low productivity. The number of cattle is 2.1 million, pigs - 4.7 million, sheep - 9.9 million. The share of milk production is 2.8% in the EU structure; cattle meat - 0.73%; poultry meat - 2.97%; pork - 1.43%; fresh vegetables - 6.43% and oats and spring mixtures of cereals - 3.54%.

The basis of the agricultural production in Sweden is dairy products (milk, sour cream, butter and cheese), meat, barley, sugar beets and potatoes. Developed intensive dairy cattle breeding, and plant growing are also developed. The number of dairy cows in 2016 was 0.33 million. The total number of cattle was 1.43 million, and its productivity is increasing. The share of milk production is 1.77% in the EU structure; cattle meat - 1.68%; sheep and goat meat - 0.67%; poultry meat - 1.16%; pork - 0.99%; fresh vegetables - 0.88%; oats and spring mixtures of cereals - 7.69%. The country's own livestock products account for 90% of the Swedish market. Also, Sweden catches commercial fish (e.g. herring, trout and cod) for domestic consumption and delivers only a small share of the output for export. Produced food products in a greater degree cover the demand in the domestic market.

Members of Cluster Number 5 Centre Cluster contains 13 cases: Bulgaria (64.81); Croatia (136.65); Cyprus (306.96); Greece (331.62); Estonia (163.66); Hungary (382.14); Latvia (74.77); Lithuania (234.35); Luxembourg (258.87); Malta (380.24); Portugal (395.00); Slovakia (182.85); Slovenia (155.92). This group includes industrial countries characterized by low provision of their own food (for example, Luxembourg), EU subjects with a high share of crop production in agriculture (e.g. Bulgaria and Greece), subjects with extensive farming and incomplete chains for the processing of agricultural products (e.g. Portugal).

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