

**IDENTIFICATION OF PRODUCT GROUPS RECOMMENDED  
FOR TRADE ON THE FOOD PLATFORM IN TERMS  
OF DOMESTIC AND FOREIGN TURNOVER\***

IWONA SZCZEPANIAK  
ŁUKASZ AMBROZIAK  
JADWIGA DROŹDŹ

**Abstract**

*The electronic trading platform for agri-food products could improve the efficiency and effectiveness of food trade and strengthen Poland's position on the global market. In Poland, there has been no such solution so far, hence the Ministry of Agriculture and Rural Development has taken the initiative to create an electronic trading platform called "Food Platform". Its essence will consist in matching secure buy and sell transactions. The purpose of the paper is to identify groups of products recommended for trade on the Food Platform in terms of domestic and foreign turnover. The study identifies sectors of the Polish food industry, with the most significant share, and identified agricultural products that are particularly important for Polish agriculture. In other words, the agri-food sectors that could potentially deliver products to the sales platform were selected. Next, this selection was verified in terms of the possibility of trade activities on the world market. The analysis shows that the product groups recommended for trade on the Food Platform are: cereals, rapeseed, sugar, fruit and vegetables, milk, red meat and poultry meat, together with their preserves.*

---

\* The study used the results of the project entitled "Food Platform" (acronymed as SELFOOD) financed by the National Centre for Research and Development as part of the Programme "Social and economic development of Poland under the conditions of globalising markets GOSPOSTRATEG" under the Agreement No Gospostrateg 1/385521/2/NCBR/2018.

---

*The authors are employees of the Institute of Agricultural and Food Economics – National Research Institute, Food Industry Economics Department; ul. Świętokrzyska 20, 00-002 Warsaw.  
Dr Iwona Szczepaniak (Iwona.Szczepaniak@ierigz.waw.pl); ORCID iD: 0000-0002-1511-4428.  
Dr Łukasz Ambroziak (Lukasz.Ambroziak@ierigz.waw.pl); ORCID iD: 0000-0001-8708-841X.  
Mgr Jadwiga Drożdż (Jadwiga.Drozdz@ierigz.waw.pl); ORCID iD: 0000-0003-3096-3177.*

*The selection of specific products which may be the subject of commercial transactions on the sales platform will result from further detailed analyzes of individual agri-food markets.*

**Keywords:** Food Platform, agri-food products, electronic commerce, food industry, agriculture.

**JEL codes:** F14, Q02, Q13, Q17.

---

## Introduction

The agri-food sector, i.e. agriculture and the food industry, is a very important part of the Polish economy. Poland is the sixth, in terms of value, largest producer of food in the European Union (EU) and its seventh exporter. At the same time, the structure of domestic wholesale trade in food seems to be highly obsolete. We do not have modern agri-food stock exchanges (electronic spot markets) where it would be possible to trade in large streams of agricultural raw materials and food products of proper quality. In order to make trade in food more efficient and effective and identifying this need, the Ministry of Agriculture and Rural Development took an initiative to create an electronic sales platform for agri-food products.

The creation of an electronic sales platform under the name of “Food Platform”, i.e. associating secure buy and sell transactions, is to enable the concentration of the national supply of agri-food products by creating and offering for sale large homogeneous batches of commodities. Consequently, the functioning of the platform is to reduce the transaction costs and business risk as well as to reduce the price and exchange rate risk, as transactions will be concluded based on standardised agreements and documents. When selling their products through the platform, the supplier (agricultural producer, food processor) is guaranteed both payment and a safe and quick transaction while the buyer (from home or from abroad) is guaranteed that a large homogeneous batch of a good quality commodity will be supplied. On the platform, agri-food products will be traded in a form of trading sessions or auctions. The organiser of the Food Platform is to be an entity selected under a public tender, whose activities will be supervised by the Polish Financial Supervision Authority. The functioning of the platform is to be widely publicised (Ploplis, 2018; PAP 2017).

Participants in the sales platform can be virtually all entities of the agri-food sector that meet the requirements contained in the rules of the Food Platform. Participation in selling through the platform would bring benefits not only to large companies but also to smaller entities which have problems with the independent use of commodity exchanges in the EU. In the implementation of the project, authorised warehouses will also be used, where uniform rules will be applicable, including the limits of fees for storing commodities.

Both crop and livestock products will be traded on the platform; they ought to be mass products for which the typical quality features, could be determined in order

to standardise them. The range of products to be traded on the Food Platform will be gradually expanded. The intention of the platform's initiators is to start with spot contracts, followed by the gradual shifting to futures and offering an increasingly wider range of products (Ploplis, 2018; PAP, 2017).

The objective of the study was to select product groups recommended for trade on the Food Platform in terms of domestic and foreign turnover; in other words, to indicate aggregated groups of commodities, which include specific products, that may become a subject of commercial transactions between agricultural producers, food processors and traders, as well as between domestic and foreign partners.

Taking into account the objectives of the Food Platform, this paper was started with a brief review of the literature regarding the characteristics of e-commerce in the agri-food sector. Basic concepts, benefits and factors for the development of e-commerce in agri-food products have been discussed.

Later on, the branches of the food industry, whose share is particularly significant, i.e. the branches which can potentially supply products to the sales platform, have been identified. Moreover, the structure of agricultural commodity production and the structure of purchase of agricultural products have been analysed, which allowed to identify agricultural products that are particularly important for Polish agriculture and may also be a subject of trade on the sales platform. Based on the analysis of data seven sectors covering both agricultural products and processed food products that can be recommended for sale on the sales platform were identified.

In the next part of the text the selection of sectors in terms of a possibility of trade with companies whose activities on the platform would primarily be focused on the export and import of food products was revisited. The basis of this selection were mainly the results of foreign trade in individual groups of agri-food products, complemented by an analysis of the competitive position of producers of these commodities in the global market.

The analysis covers the years 2006-2016 and, in some cases, also 2017. In the study used the data from the Central Statistical Office and the Ministry of Finance (unpublished data on Polish trade), as well as the data from the WITS-Comtrade database (world trade data) were used.

## **E-commerce in the agri-food sector – selected aspects**

### ***Basic concepts***

The dynamic development of information and communication technologies (ICT), observed since the 90s of the 20<sup>th</sup> century, resulted in revolutionary changes in many areas of the economy. One of those areas was trade. The popularisation of the Internet fostered the creation of various electronic platforms used for concluding sales transactions and buying commodities and services without a need for personal contact. E-commerce has become an important distribution channel for companies.

In the literature, there are many definitions of e-commerce<sup>1</sup>. For the first time, e-commerce was defined by the Organisation for Economic Cooperation and Development (OECD) in 1997. According to this definition, e-commerce means “any forms of transaction related to the commercial use of individual and institutional business entities when relying on digital processing and data transmission”. Later on, it has been specified that e-commerce consists of electronic transactions (sale or purchase of commodities or services (conducted over computer mediated networks) and Internet transactions (transactions conducted over the Internet) (OECD, 2002). The World Trade Organisation (WTO, 2019) defines e-commerce as “production, advertising, sale and distribution of products via telecommunications networks”. According to the Central Statistical Office (CSO, 2019), “e-commerce” is understood as “transactions conducted over IP-based networks and other computer networks”. It has been explained that “commodities and services are ordered by these networks, but payment and final delivery of an ordered commodity or service may be made within or outside the network”. In all the above-quoted definitions, one common element can be distinguished, i.e. the conclusion of transactions through electronic media.

The freedom to initiate transactions means that transactional relationships can take a different direction. The following transactions can be distinguished: between businesses (business to business – B2B), between a business and a consumer (*business to consumer* – B2C), between a consumer and a business (*consumer to business* – C2B), between consumers (*consumer to consumer* – C2C), between a business and administration (*business to administration* – B2A) and between a consumer and administration (*consumer to administration* – C2A). Fritz, Hausen i Schiefer (2004) note that the most common relationships are B2B and B2C.

### ***Benefits of e-commerce***

The development of e-commerce in commodity exchanges (B2B relation) and the development in a form of other platforms allows trade participants – companies being buyers and sellers – to draw many benefits. The dissemination of information and communication technologies clearly reduced the transaction costs of such trade through, *inter alia*, facilitating access to information, reducing the time of conducting transactions, enabling negotiations between geographically remote buyers and sellers, facilitating the monitoring of transactions (Porter, 2001; Xiaoping, Chunxia, Dong and Xiaoshuan, 2009; Laudon and Traver, 2017; Gaffar Khan, 2016). By concentrating a large number of buy and sell offers in one point of cyberspace, electronic markets contribute to increasing transparency of information on prices and products in the market. This allows sellers to increase the number of buyers and provides buyers with access to more suppliers (Strzębicki, 2016). Thanks to digital technologies, the physical distance between trade participants is currently not much important. No personal contact between the seller and the buyer

---

<sup>1</sup> A wider review of the definition was carried out by Bartczak (2016, pp. 32-63).

is required to conclude the transaction, and any issues related to its conduct can be completed using remote means of communication (Mueller, 2003). E-commerce allows sellers to expand their selling opportunities, and enables buyers to obtain access to a wider range of products which are often unavailable in the local or domestic market (Porter, 2001; Laudon and Traver, 2017). From the point of view of the agri-food sector, changes in the supply chain are an important benefit for sellers (agricultural producers) participating in e-commerce. These changes consist in eliminating traditional commercial intermediaries, i.e. wholesalers and retailers (this is the so-called “disintermediation”), often gaining high margins (Xiaoping et al. 2009; Montealegre, Thompson and Eales, 2007). Owing to the information and communication technology in place of the intermediary a direct relation of the seller with the buyer is established (Laudon and Traver, 2017).

### ***Factors for the development of e-commerce in agri-food products among companies***

The literature of the subject identified the major factors for the development of e-commerce in agri-food products among companies (in the B2B relation). They are as follows:

#### ***1. Large fragmentation of supply chains (marketing chains)***

In the agri-food sector, there is a large, mostly vertical, fragmentation of supply chains. They include many links, starting from manufacturing the production means to selling finished food products to consumers (Montealegre et al., 2007). This involves a large number of commercial intermediaries (wholesalers and retailers) who capture some of added value in a form of margins generated in the individual value chain links. Elimination (the so-called disintermediation) of intermediaries allows product suppliers to take over margins. Therefore, the large fragmentation of supply chains makes the agri-food sector susceptible to participation in e-commerce, thanks to which it can have many benefits.

Strzębicki (2015) additionally points out that in the Polish agri-food market there is an exceptionally high number of commercial intermediaries who buy agricultural commodities from producers and then sell them, with appropriate margins, to customers from the further food chain links. A particularly large number of intermediaries are characteristic of the market for cereals, fruit and vegetables and live animals.

#### ***2. Specificities of the sectors of industry, where products are manufactured***

According to Porter (2001), the specificities of a given branch of the industry is a key factor affecting the development of e-commerce in products of this branch. Leroux, Wortman and Mathias (2001) believe that markets ideal for the development of e-commerce are highly dispersed markets – on the part of sellers, buyers or both of them. As consolidation processes become intensified in individual branches of the industry, the tendency of entities to introduce solutions based on modern

technologies is decreasing. However, Henderson, Dooley and Akridge (2000) note that even large companies may be interested in e-commerce if this allows them to significantly reduce the transaction costs.

### **3. Type of products subject to trade**

The subject of e-commerce in the agri-food sector may be both agricultural commodities (especially raw materials) and finished food products bought by consumers (*Analysis...*, 2018). However, trade between companies (B2B relationship) mainly applies to agricultural commodities. It is characterised by a high degree of standardisation, relatively large – both in quantitative and in value terms – scale of transactions and institutionally structured nature. The places to trade in these products are often defined as the commodity exchanges. Trade on such exchanges has been virtually completely electrified. Food products are a subject of e-commerce to a much lower extent than agricultural commodities due to significant difficulties in standardising these products. An example of trade in agri-food products are organised electronic auctions (e.g. Dutch flower, fruit and vegetable auctions) (*Analysis...*, 2018).

Therefore factors conducive to the development of e-commerce in the agri-food sector among business partners are as follows: fragmentation of supply chains increasing a need to coordinate the individual links of these chains, large number of commercial intermediaries, low level of consolidation of branches and mass production of homogeneous commodities. Leroux et al. (2001) point out that one of the important barriers to the development of e-commerce is the specific nature of transactions in the agri-food sector consisting in close relationships between business partners (*high-touch nature of transactions*). In fact, the interpersonal aspect of the relationship in this sector is often more important than the transactional aspect (especially when it is considered only in the short term) and social capital and trust may prove, in some situations, to be a more important factor in reducing the transaction costs than the benefits of developing ICT technology. This is also stressed by Macneil (1985), claiming that in the context of relational contracting and trust embedded rooted in interpersonal relationships, the potential role of electronic platforms may be overestimated.

#### **Agri-food sector in commodity terms**

##### ***Branch structure of the food industry***

The food industry covers a very wide area of economic activity. It is composed of companies involved in processing animal products (meat, fish and dairy industry), processing plant products (cereal, fruit and vegetable, potato, oil and sugar industry), secondary processing (bakery, feedstuffs, confectionery, pasta, food concentrates and soft drinks industry) or the production of stimulants (alcohols and tobacco products). Products in this sector may either be low processed (as in the case of animal slaughters and meat cutting) or be a result of advanced technological processes (as in the case of freeze-dried or functional food).

Approximately 30% of entities involved in the production of food and beverages are processors of products of animal origin, including 20% – meat companies, and about 4% – dairy companies. The share of the meat sector in the sold production of the food industry is estimated at around 30%, and in the gross value added generated in this production section – about 20%, with the 30% share in the number of working persons (Table 1). A significant processor of products of animal origin is also the dairy sector, which employs about 10% of persons working in the food industry. Its share in the turnover of the sector is higher, as sales of dairy products account for 13-15% of the revenues of the food industry, with the 10% share in the gross value added generated.

Almost 1/10 of food companies are involved in processing plant products, and among them the largest sector is the fruit and vegetable industry. Companies in this sector account for about 6% of total food entities and employ 7-8% of persons employed in the whole food industry. The share of this industry in the total turnover and gross value added of the agri-food sector is similar to those generated by food, drink and tobacco products. In the processing of plant products, the cereal industry is also relatively large. The original processing of cereals is carried out by 2.5% of food companies, which also employ about 2.5% of persons employed in the production of foodstuffs, beverages and tobacco products. This branch generates about 3% of the value of the sold production of the food industry and its share in generating gross value added of the sector is at the same level.

The sugar and oil industry occupies a lower position in food processing, especially in terms of the number of companies and the share in employment (less than 1%). However, the value of production generated in these industries represents a higher percentage in trade in food products (2-3% each) and gross value added – oil industry about 3%, and sugar industry – from 3 to more than 8%.

The main industries in processing products of animal origin and almost all industries in processing of plant products cover a significant part of the whole domestic food industry. Companies belonging to the meat (including poultry), dairy, cereal, fruit and vegetable, oil and sugar industries account for more than one third of all food processing entities. They employ more than half of persons employed in the food industry (50.7%). They produce 57% of the value of the sold production of food products and nearly 47% of gross value added of the domestic food industry. Importantly, these industries, being purchasers of agricultural products, are very strongly directly linked with domestic agriculture.

Table 1

## Average employment (thous. people), sold production (at current base prices, billion PLN) and gross value added (at current prices, million PLN) of the food industry by branches in 2006 and 2016

Specification	Average employment in the food industry by industries (thousand persons)		Sold production of the food industry by industries (at current base prices, billion PLN)		Gross value added of the food industry by industries (at current prices, million PLN)	
	2006	2006=100	2006	2006=100	2006	2016=100
<b>Food industry</b>	<b>391.7</b>	<b>388.4</b>	<b>120.2</b>	<b>210.7</b>	<b>25,329</b>	<b>42,345</b>
including industries of:						
meat (including poultry)	111.5	100.8	31.6	61.7	4,710	8,428
fish	13.9	125.9	3.9	10.4	633	1,717
potato	4.1	75.6	1.3	2.3	426	582
fruit and vegetable	33.5	86.0	10.6	14.7	2,241	3,192
oil	3.4	2.6	2.7	4.1	588	481
dairy (including ice-cream)	43.0	37.2	17	26.2	2,676	3,967
cereal	9.2	9.7	3.7	6.3	744	1,284
pasta	4.2	4.0	0.6	1.3	122	309
feedstuffs	10.1	118.8	7.8	15.6	1,287	2,403
bakery	71.4	80.4	6.6	13.5	1,171	3,465
confectionery	27.6	28.0	7.6	11.2	2,074	3,458
food concentrates	16.7	22.1	5.4	15.4	1,439	3,971
sugar	8.4	3.3	4.6	4.4	2,036	1,893
soft drinks	11.5	8.6	3.9	6.5	1,060	1,726
spirits	5.6	4.0	2.5	3.5	655	1,129
wine	2.0	1.2	0.6	0.6	127	200
beer	9.0	7.9	6.7	7.9	2,567	2,564
tobacco	6.6	5.6	3.1	5.1	773	1,576

<sup>a</sup> applies to industrial companies which submitted financial statements F-01/1-01.

Source: own study based on the unpublished data of the Central Statistical Office (CSO).



### Agricultural commodity production and purchase of agricultural products

In 2006-2016, the value of agricultural commodity production rose by 2/3 in nominal terms and by 1/3 in real terms (i.e. at constant prices). However, the development of agricultural commodity production did not increase its share in resources of raw materials of food processors. This share is currently estimated at about 60-65%, whereby the value of this index shows a downward trend in longer term. In the middle of the last decade, agriculture supplied around 75% of raw materials for the production of food products, but the high growth rate of import of agricultural products and semi-finished products reduced the importance of agriculture in supplying raw materials to food companies. Although the share of agriculture in both the resources of production factors and production results or income of the food industry is decreasing, these links still remain very strong (Szczepaniak, 2017). Among the major product groups produced in the agricultural sector in 2006-2016, there was a large increase in the commodity production of live animals for slaughter, including, in particular, poultry (on average, by more than 10% a year) and cattle (by nearly 8% a year) and vegetables and wheat (on average, by 7-8% a year each). The commodity structure of agricultural production was dominated by animal products, which accounted for 56-58% of the commodity value of the production of that section. Among these products, the largest share was that of live animals for slaughter (32-36%), where the major position is occupied currently by poultry (almost 15%) and then pigs (more than 13%). In the first years of EU membership, the share of pigs in the agricultural commodity production was higher than that of poultry, but in the following years these relationships changed (Table 2).

Table 2

*Agricultural commodity production (current prices)  
and value structure of agricultural commodity production (%)*

Specification	Agricultural commodity production (current prices)			Value structure of agricultural commodity production (%)	
	2016 (billion PLN)	2006=100	Annual average	2006	2016
<b>Total commodity production</b>	<b>76.5</b>	<b>166.7</b>	<b>5.2</b>	<b>100.0</b>	<b>100.0</b>
of which: crop production	32.0	166.7	5.2	41.8	41.8
including: cereals	8.7	185.1	6.4	10.2	11.4
including: wheat	4.9	196.0	7.0	5.5	6.4
industrial	5.2	144.4	3.8	7.8	6.8
vegetables	6.5	209.7	7.7	6.8	8.5
fruit	5.2	173.3	5.7	6.5	6.8
of which: animal production	44.5	166.7	5.3	<b>58.2</b>	<b>58.2</b>
including: live animals for slaughter	27.3	171.7	5.6	34.6	35.6
including: cattle	5.5	211.5	7.8	5.7	7.2
pigs	10.1	117.4	1.6	18.7	13.2
poultry	11.4	278.0	10.8	8.9	14.9
cow's milk	12.1	145.8	3.8	18.1	15.8

Source: own study based on the data of the CSO.

In recent years, 2-2.3 million tonnes of pigs (in live weight) and 2.5-3 million tonnes of poultry (Table 4) have been purchased annually. An important and significant component of the agricultural commodity production was also cow's milk, which in recent years has accounted for about 16% of the value of agricultural commodity production, i.e. by 2-3 p.p. less than in the middle of the previous decade. After lifting the milk quotas, purchase of cow's milk increased and amounted to more than 10 million litres a year. Around 7% of the agricultural commodity production was cattle for slaughter, whose purchase in live weight has exceeded 800 thousand tonnes for several years (Table 4).

About 42-44% of the agricultural commodity production accounted for the crop production, in which the highest share was that of cereals (about 10-14%), including wheat. Its share ranged from 5.5% of the value of agricultural commodity production in 2006 to 6.7% in 2010 and 6.4% in 2016. In recent years, 6.5-7.6 million tonnes of wheat have been purchased annually, almost 2 times more than in the middle of the previous decade. The production of vegetables and fruit was significant as well. In 2016 their share in the agricultural commodity production was 8.5 and almost 7.0% respectively, which means that it was considerably higher than in the previous decade. In the last several years, the subject of purchase have been around 1.7-1.8 million tonnes of vegetables and about 2.5-2.8 million tonnes of fruit annually (Table 4).

Table 3

*Value structure of purchase of agricultural products (%)*

Specification	2006	2016
<b>Total purchase</b>	100.0	100.0
<b>Plant products</b>	<b>28.8</b>	<b>32.2</b>
including consumer and fodder cereals	9.9	12.8
including: wheat	6.4	8.1
sugar beet	4.8	2.6
rape and turnip rape	4.8	3.8
vegetables	2.2	3.1
fruit	3.5	4.8
<b>Animal products</b>	<b>71.2</b>	<b>67.8</b>
including: cattle	8.0	8.2
pigs	24.6	18.5
poultry	11.2	18.7
cow's milk	24.9	20.6

Source: own study based on the data of the CSO.

The value of purchase of agricultural products accounted for more than 3/4 of the value of agricultural commodity production. More than two-thirds of the value of this purchase were animal products, of which the share of cow's milk was largest (more than 20%), followed by the share of poultry and pigs (about 18.5% each). In recent years, the share of purchase of poultry has exceeded the share of purchase

of pigs, while in the middle of the previous decade the share of purchase of pigs was 2 times higher than that of poultry (Tables 3 and 4). This process illustrates the dynamic development of the production and processing of live poultry in Poland, which took place after obtaining free access to the European market. In purchase of plant products, the highest position had cereals, whose share was nearly 13% of the value of purchased agricultural products. Among cereals, the greatest role was played by wheat whose share in total purchase of agricultural products was about 8%. Among other plant products, attention should be paid to fruit (share in purchase at a level of about 5%), vegetables (more than 3%) and rape (about 4%).

Table 4

*Purchase of more important agricultural products (thousand tonnes)*

Specification	2016	2006=100	Annual average growth rate (%)
Cereals	12,776	179.3	6.0
including consumer and fodder cereals	12,706	179.4	6.0
including: wheat	7,625	170.0	5.5
sugar beet	13,242	114.8	1.4
rape and turnip rape	1,346	84.3	-1.7
vegetables	1,741	155.9	4.5
fruit	2,540	199.7	7.2
Live animals for slaughter (in live weight)	6,108	149.3	4.1
including: cattle	818	134.8	3.0
pigs	2,315	106.2	0.6
poultry	2,949	232.4	8.8
cow's milk (million litres)	10,810	128.4	2.5

Source: own study based on the data of the CSO.

## **Agri-food sector in trade<sup>2</sup>**

### ***Export in commodity terms***

The current commodity structure of Polish agri-food export is a result of changes that occurred during the period analysed. In 2006-2017, the export value of nineteen (out of twenty) groups of agri-food products increased. Nine groups saw an increase higher than average (Fig. 1). The largest increase was recorded in the export of tobacco and cigarettes, coffee, tea, cocoa and spices, cereals and cereal products, poultry and poultry products, beef and pork along with their products. The export of, *inter alia*, fruit and fruit products, vegetables and vegetable products, mushrooms and mushroom products and dairy products developed more slowly than on average. Foreign sales of live animals decreased by as much as 2/3.

<sup>2</sup> The division of agri-food products into commodity groups has been made with reference to the Polish Classification of Activities (PKD), in accordance with the objectives of the GOSPOSTRATEG project.

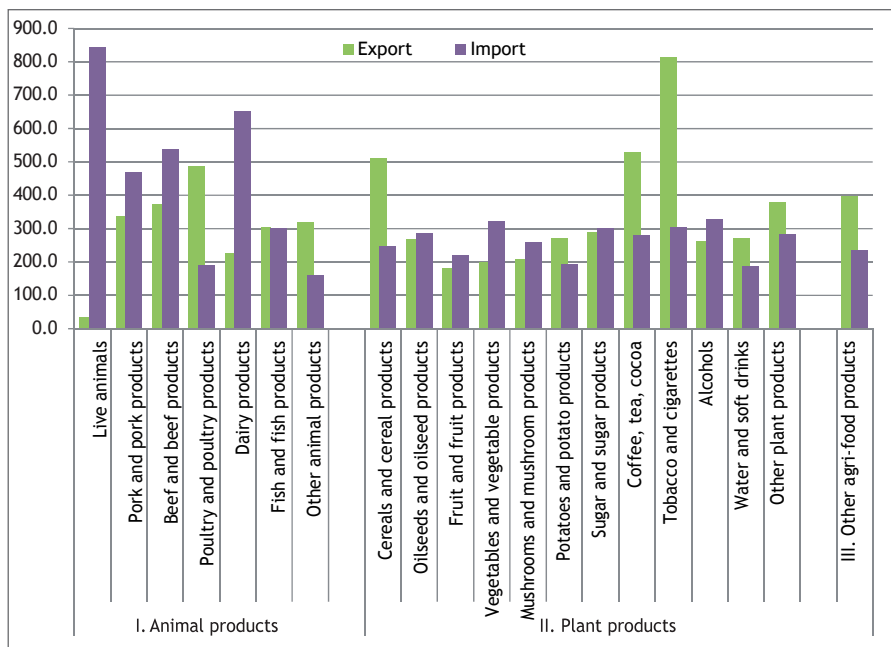


Fig. 1. The growth rate of the Polish agri-food export and import in commodity terms in the years 2006-2017 (2006 = 100%).

Source: own study based on the unpublished data of the Ministry of Finance.

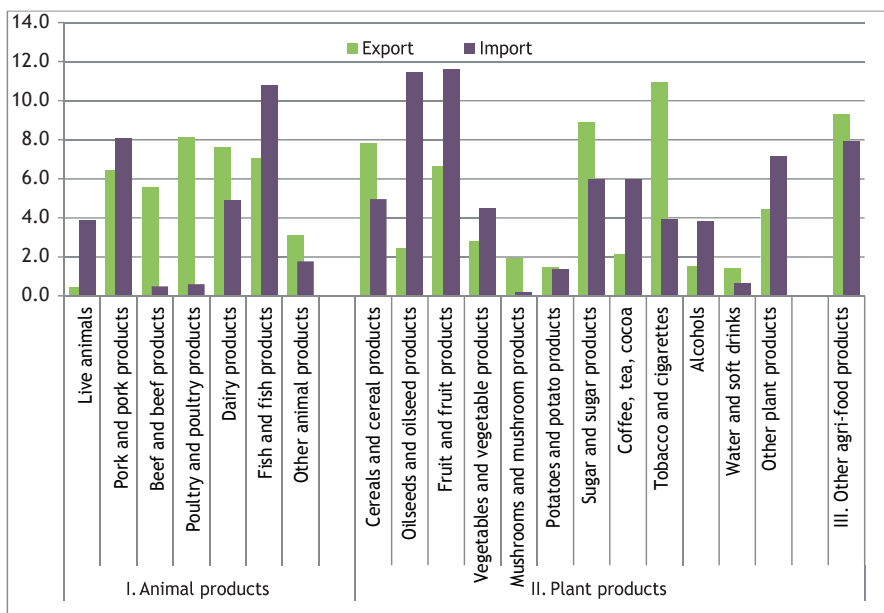


Fig. 2. Commodity structure of the Polish agri-food export and import in 2017 (%).

Source: own study based on the unpublished data of the Ministry of Finance.

As a result, there was a reshuffle in the list of ten major commodity groups – vegetables and products disappeared while tobacco and tobacco products appeared. In 2017, the most important product groups in the Polish agri-food export were tobacco and cigarettes (10.9%), sugar and sugar products (8.9%), poultry and poultry products (8.1%), cereals and cereal products (7.8%), dairy products (7.6%), fish and fish products (7.1%), fruit and fruit products (6.7%), pork and pork products (6.5%) and beef and beef products (5.6%) (Fig. 2). During the analysed period, the degree of concentration of the Polish agri-food export to the global market increased, as 10 major commodity groups accounted for 78.5% of the export.

### ***Import in commodity terms***

In 2006-2017, the import value of all groups of agri-food products increased. In the case of nine of them, the increase was higher than average – Fig. 1. What increased the most, was the import of live animals, dairy products, beef and beef products, pork and pork products, alcohols and tobacco and cigarettes. The import of other animal products, poultry and poultry products, potatoes and potato products and water and soft drinks increased the least. As a result, vegetables and vegetable products disappeared from the list of ten major commodity groups in the import, while dairy products appeared. When compared with 2006, the degree of concentration of the Polish agri-food import decreased, as in 2017 ten main commodity groups accounted for 78.9% of the import.

### ***Balance of trade in commodity terms***

In 2017, the balance of trade in agri-food products of Poland was positive for twelve product groups (in 2006 – 15 groups). The largest surplus was achieved in trade in: tobacco and cigarettes (EUR 2,237 million), poultry and poultry products (EUR 2099 million), beef and beef products (EUR 1,427 million), sugar and sugar products (EUR 1,294 million), cereals and cereal products (EUR 1,198 million), dairy products (EUR 1,153 million) and other agri-food products (EUR 1,041 million) – Fig. 3. The balance of trade in pork and pork products, other animal products, mushrooms and mushroom products, water and soft drinks, potatoes and potato products was also positive. In 2006-2017, the surplus value in trade in tobacco and tobacco products (by more than EUR 2.1 billion), poultry and poultry products increased the most (by EUR 1.7 billion), cereals and cereal products (by almost EUR 1.2 billion) and beef and beef products (by slightly more than EUR 1 billion) increased the most. In 2017, the highest deficit was generated by trade in oilseeds and oilseed products, live animals, coffee, tea and cocoa, fruit and fruit products and alcohols.

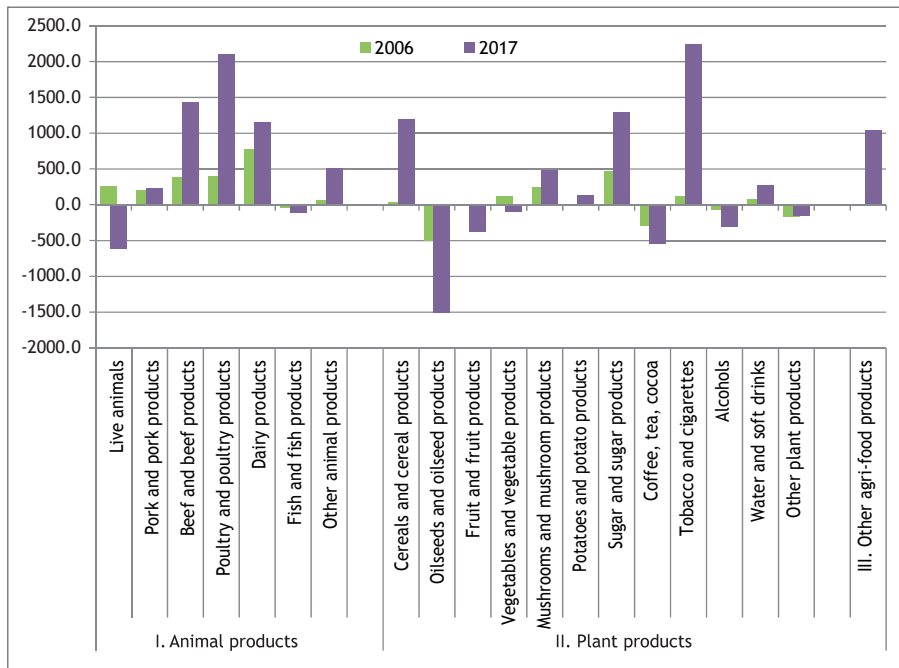


Fig. 3. Balance of trade in Polish agri-food products in commodity terms (million EUR)

Source: own study based on the unpublished data of the Ministry of Finance.

## Competitive position in trade in agri-food products

### *Method of measuring the competitive position*

To assess the competitive position of Poland in trade in agri-food products, two indices of the competitive position were used i.e. trade coverage index (TC) and the revealed comparative advantage index (RCA). These indices belong to the group of *ex post* competitiveness indices, i.e. they refer to the measurement of competitiveness in the past (Misala, 2011). The TC index determines the extent to which expenses on imported commodities are covered by revenues from their export. The TC value higher than 100% means that a country has the relative internal advantage over partners, as the export value exceeds the import value (Ambroziak and Szczepaniak, 2013). The RCA index takes values from zero to infinity, with two ranges with different interpretations identified. When this index takes values higher than 1 (the share of a group of commodities in the export of a country is higher than the relevant share in the global export), a country has the revealed comparative advantages in the export to a specific market. Otherwise, when the index takes values lower than 1 (the share of a group of commodities in the export of a country is lower than the share of that group of commodities in the global export), a country does not have the revealed comparative advantages in the export to this market. The presence or absence of revealed comparative advantages is therefore

determined by the fact whether the share of a particular group of commodities in the export of a country to a specific market is higher or lower than the appropriate share of that commodity in the export of all countries of the world to this market (Balassa, 1965).

### *Trade coverage index in commodity terms*

Among product groups, in trade of which a surplus was recorded in 2006, in 2017 it was possible to maintain it in twelve groups, whereby in seven of them the TC indices increased (poultry and poultry products, other animal products, cereals and cereal products, potatoes and potato products, tobacco and cigarettes water and soft drinks and other agri-food products), and in five of them they decreased (pork and pork products, beef and beef products, dairy products, mushrooms and mushroom products, sugar and sugar products) (Fig. 4). The surplus could not be maintained in trade in live animals, fruit and fruit products and vegetables and vegetable products. The permanent deficit in trade was characteristic of the following agri-food products: fish and fish products, oilseeds and oilseed products, coffee, tea, cocoa and spices and alcohols.

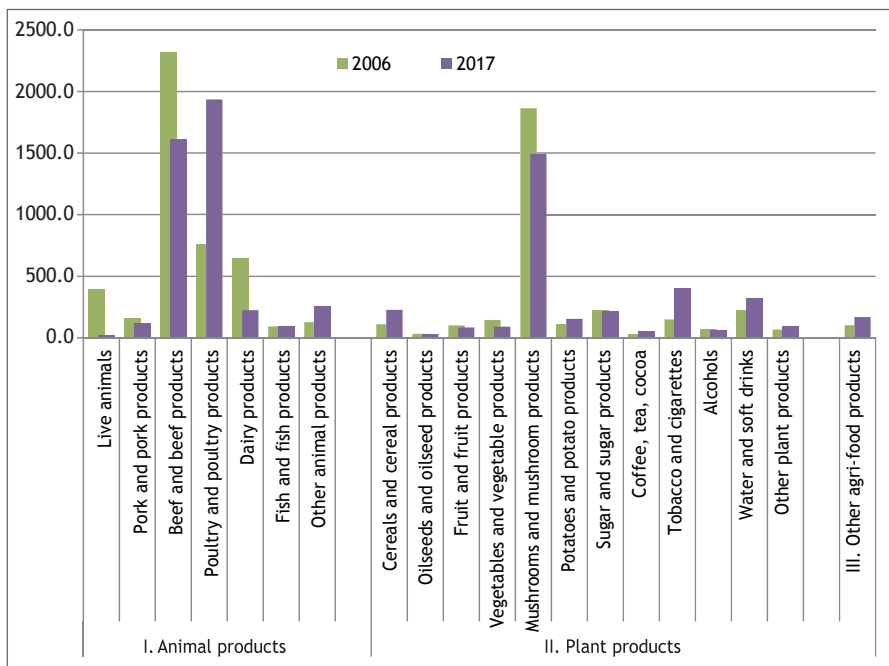


Fig. 4. TC indices in Polish agri-food trade by product groups (%).

Source: own study based on the unpublished data of the Ministry of Finance.

In 2017, Poland reached a surplus in trade in twelve (out of 20) product groups (Fig. 4). The highest TC indices were recorded in the groups such as poultry and poultry products (TC = 1,935%), beef and beef products (TC = 1,614%) and mushrooms and mushroom products (TC = 1,493%). This means that the export value of those products was several times higher than their import value. In the tobacco and cigarettes group, the surplus of export over import was 4 times higher and for water and soft drinks it was more than 3 times higher. High TC indices were also characteristic of trade in dairy products, other animal products, cereals and cereal products, and sugar and sugar products. On the other hand, the relatively lowest surplus (TC under 170%) was recorded in the groups such as pork and pork products and potatoes and potato products. The trade deficit was recorded in eight product groups. These were: live animals, oilseeds and oilseed products (TC < 40%), coffee, tea, cocoa and spices, alcohols (40% < TC < 60%), as well as fruit and fruit products, vegetables and vegetable products, other plant products (80% < TC < 90%) and fish and fish products (TC = 95%).

### ***Revealed comparative advantage index in commodity terms***

Among fifteen product groups in the export of which Polish producers had the revealed comparative advantages in 2006, in 2017 such advantages were maintained in thirteen groups. In eleven groups, the RCA indices increased. In the export of dairy products and vegetables and vegetable products, these indices decreased. In 2006-2017, the position of Polish food producers was most strengthened in the export of mushrooms and mushroom products (an increase in the RCA index by 4.66 points), tobacco and cigarettes (by 3.51 points) and poultry and poultry products (by 1.70 points). Polish food producers failed to maintain the comparative advantages they had in 2006 in the export of live animals and fruit and fruit products. In 2006-2017, Poland managed to obtain the comparative advantages in the export to the global in only one product group, i.e. other plant products. Despite the increased value of the RCA indices, Polish food producers were still uncompetitive in the global market as regards the export of cereals and cereal products, as well as of coffee, tea, cocoa and spices.

In 2017, Poland had the revealed comparative advantages in the export to the global market in fourteen (out of 20) product groups (Fig. 5). The highest RCA indices were recorded in the export of mushrooms and mushroom products (RCA = 15.44), as well as tobacco and cigarettes and poultry and poultry products (RCA = 5.37 and RCA = 5.36, respectively). This means that the share of mushrooms and their products in the Polish export in total was more than 15 times higher than the share of those products in the global export, while the share of tobacco and cigarettes and of poultry and poultry products was more than 5 times higher. Polish producers of pork and pork products, sugar and sugar products, other animal products, dairy products and beef and beef products also held a strong competitive position in the global market (RCA > 2.00). The high RCA indices (above 1.50) were also achieved by exporters of potatoes and potato products and of water and soft drinks.



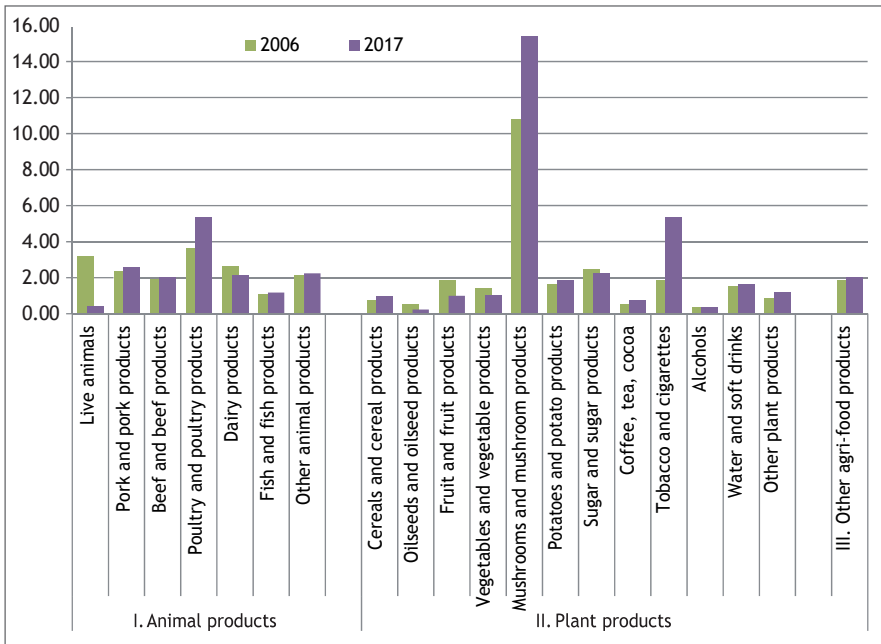


Fig. 5. RCA indices in the Polish agri-food export by product groups (%).

Source: own study based on the unpublished data of the Ministry of Finance and WITS-Comtrade.

In 2017, six product groups (out of 20), Poland did not have the comparative advantages in the export to the global market, whereby in two groups (live animals and fruit and fruit products) it lost those advantages during the period analysed. In the next two groups (oilseeds and oilseed products and alcohols), Polish food producers did not have comparative advantages throughout the period analysed, and in two other groups (cereals and cereal products and coffee, tea, cocoa and spices) – in part of the period analysed.

### ***Identification of promising groups of agri-food products in terms of a possibility of economic activity in the global market***

Based on the analysis carried out and on eight criteria, groups of agri-food products, which may include products for export using the Food Platform, have been identified. For each of the adopted criteria, a limit value has been set out, the exceedance of which suggests that a given product group may be prospective from the point of view of Polish exporters. The following criteria have been adopted (in the parentheses, the limit value is provided):

- share of the given group in the export in 2017 (product groups with the share of more than 5% were considered promising);
- growth rate of the export of the given group in the years 2006-2017 (an increase higher than average for all agri-food products, i.e. higher than 218.5%);
- balance in 2017 (occurrence of a surplus);

- change in the value of the balance in 2006-2017 (improved balance of trade in the given product group);
- RCA index in 2017 ( $RCA > 2$ , indicating the strong comparative advantages in the global market);
- change in the value of the RCA index in 2006-2017 (increased RCA index);
- TC index in 2017 ( $TC > 200\%$ , which means that the export value of the given product group exceeds the import twice);
- change in the value of the TC index in 2006-2017 (increased TC index).

The choice was made from among seventeen product groups, thus excluding the following groups: other animal products, other plant products and other agri-food products. In general, those product groups where the values of more than half the indices (at least five) exceeded the above-mentioned limit values (Table 5) were generally considered as promising. They were therefore: poultry and poultry products (8 indices above limit values), beef and beef products (7), cereals and cereal products (7), pork and pork products (6), dairy products (5), mushrooms and mushroom products (5), sugar and sugar products (5). Therefore, they are mostly agricultural commodities characterised by a high degree of standardisation and by a relatively large – both in quantitative and value terms – scale of transactions (*Analysis...*, 2018).

Products which were considered promising in the context of launching the Food Platform did not include tobacco and cigarettes and water and soft drinks, which resulted from the specificities of their production. As Figiel points out, the subject of trade on the Food Platform can be mainly homogeneous products, easy to standardise (*Analysis...*, 2018). In the two above-mentioned groups, there are few such products.

Table 5  
*Specification of the indices being a basis for choosing the groups of agri-food products considered promising*

Produkty	Share in the export in 2017 (%)	Growth rate of the export in 2006-2017 (2006=100%)	Balance in 2017 (million EUR)	Change in the balance in 2006-2017 (million EUR)	RCA index in 2017	Change in the RCA index in 2006-2017 (pts)	TC index in 2017	Change in the TC index in 2006-2017 (p.p.)
I. Animal products	38.3	295.1	4,692.3	2,663.7	2.04	-0.01	181.2	-52.32
Live animals	0.4	34.4	-616.4	-875.4	0.39	-2.82	16.2	-380.67
Pork and pork products	6.5	336.3	231.5	35.0	2.59	0.21	115.1	-44.91
Beef and beef products	5.6	372.8	1,427.1	1,306.6	2.01	0.08	1,614.2	-708.86
Poultry and poultry products	8.1	485.8	2,098.6	1,703.1	5.36	1.70	1,935.1	1,177.18
Dairy products	7.6	227.4	1,153.2	381.2	2.12	-0.51	224.7	-419.92
Fish and fish products	7.1	303.8	-111.1	-69.8	1.16	0.10	94.6	0.66
Other animal products	3.1	319.6	509.4	453.0	2.24	0.08	251.9	124.77
II. Plant products	52.4	326.0	2,649.2	2,592.6	1.12	-0.09	122.7	21.42
Cereals and cereal products	7.8	512.2	1,198.1	1,161.3	0.98	0.23	227.4	117.72
Oilseeds and oilseed products	2.5	268.9	-1,501.4	-993.1	0.22	-0.27	30.8	-2.04
Fruit and fruit products	6.7	181.1	-376.0	-385.5	0.99	-0.89	82.9	-18.07
Vegetables and vegetable products	2.8	198.1	-89.4	-208.0	1.05	-0.36	89.4	-55.56
Mushrooms and mushroom products	1.9	208.1	489.0	250.7	15.44	4.66	1,492.9	-370.92
Potatoes and potato products	1.4	270.8	135.5	123.9	1.85	0.20	152.7	43.97
Sugar and sugar products	8.9	288.5	1,293.9	827.3	2.27	-0.18	214.1	-10.37
Coffee, tea, cocoa	2.1	528.2	-544.4	-251.6	0.73	0.23	51.8	24.35
Tobacco and cigarettes	10.9	813.0	2,236.6	2,115.0	5.37	3.51	398.6	249.07
Alcohols	1.5	262.4	-310.9	-247.7	0.38	0.00	57.3	-14.25
Water and soft drinks	1.4	272.6	265.7	187.7	1.63	0.09	323.3	99.70
Other plant products	4.4	379.5	-147.5	12.6	1.17	0.31	89.1	22.62
III. Other agri-food products	9.3	396.0	1,041.1	1,035.2	2.02	0.18	169.5	68.58
Total (I + II + III)	100.0	318.5	8,382.7	6,291.5	1.43	-0.08	144.3	12.03
Limit value	Share >5%	Growth rate >318.5	Balance >0	Increase in balance	RCA >2	Increase in RCA	TC >200	Increase in TC

Note: these indices which exceed the limit value are shown in grey.

Source: own study based on the unpublished data of the Ministry of Finance oraz WITS-Comtrade.

## Discussion and conclusions

The analysis shows that the industries of the food industry which can potentially supply products to the Food Platform, with regard to processing products of animal origin, are the following branches: meat (including poultry) and dairy, and when it comes to processing plant products, the following branches: cereal, fruit and vegetable, oil and sugar. These industries account for more than one third of all food industry entities, employ 51% of persons employed in this sector and produce 57% of the value of the sold production of food products and almost 47% of the gross value added of the food industry. These industries cover a significant part of the production potential of the domestic food industry and, in particular, they are all strongly linked to the agricultural sector, as they widely used domestic agricultural products in the production process.

This is confirmed by the structure of agricultural commodity production in which animal products such as live animals (cattle, pigs and poultry) and cow's milk account for about 51% of the commodity value of this section's production, and plant products such as cereals, fruit and vegetables and industrial plants (sugar beets, rape and turnip rape) account for about 34%. In the structure of purchase of agricultural products, the share of the above-mentioned animal and plant products is also very high and is, 66 and 27% respectively of the value of that purchase. These products are therefore extremely important for Polish agriculture and they may also be a subject of trade on the sales platform.

The results of the analyses allow to identify seven industries, covering both agricultural raw materials and food products being a result of their processing, which can be together recommended for trade on the Food Platform. These are the following industries: cereals and cereal products, rape and rape products, sugar, fruit, vegetables and vegetable products, milk and milk products, red meat and red meat products as well as poultrymeat and poultrymeat products. A significant part of products produced in these industries, due to their specificity, are eligible for the mass production and delivery to the platform in harmonised batches, can meet standard quality parameters, can be transported over long distances and stored under appropriate conditions.

Participation of producers from these industries in trade on the Food Platform would entail potential benefits for them. In the light of the theory, e-commerce allows sellers to expand the outlet possibilities (Laudon and Traver, 2017) and contributes to reducing the transaction costs, as transactions may be concluded via remote means of communication (Mueller, 2003). Also elimination of traditional commercial intermediaries and, consequently, the capture of their margins (Xiaoping et al., 2009) can also be an important benefit for sellers.

Buyers can also obtain a number of benefits through e-commerce by, *inter alia*, providing them with access to more suppliers and a wider range of products (Laudon and Traver, 2017). Buyers of products on the Food Platform can be both domestic customers (production companies, trade companies) and foreign customers.

For this reason, the above-mentioned selection of industries has been verified in terms of a possibility of doing business with entities whose activity on the platform would focus primarily on the export and import of food products. From among the above-mentioned seven industries, five were considered particularly promising when it comes to trade activity in the global market, i.e. the sector of poultrymeat, cereals, red meat, milk and sugar. Two industries, i.e. the sector of rape and fruit and vegetable, have not met the assumed criteria (these are industries where the import of raw materials from other climate zones plays a fairly significant role). Nevertheless, it was considered that those sectors, due to their great importance to the food economy as a whole, deserve the chance of being present on the sales platform.

Summing up, in our opinion, the groups of agri-food products recommended with regard to a possibility of trade on the Food Platform in the light of domestic and foreign turnover are cereals, rape, sugar, fruit, vegetables (and mushrooms), milk, red meat and poultrymeat, together with their products. Of course, only some selected products belonging to these groups will be subject to commercial transactions on the sales platform. Their selection will result from further detailed analyses of these agri-food markets.

## References

- Ambroziak, Ł., Szczepaniak, I. (2013). *Monitoring i ocena konkurencyjności polskich producentów żywności (4). Pozycja konkurencyjna*. Program Wieloletni 2011-2014, No. 74. Warszawa: IERiGŻ-PIB.
- Analiza funkcjonowania rozwiniętych i nowoczesnych giełd towarowych na świecie, rekomendująca rozwiązania dotyczące zorganizowanego handlu w formule rynku SPOT i rynku terminowego w Polsce*. (2018). Wyniki badań projektu pt. „Platforma Żywnościowa” (akronim SELLFOOD) finansowanego przez Narodowe Centrum Badań i Rozwoju w ramach programu „Społeczny i gospodarczy rozwój Polski w warunkach globalizujących się rynków GOSPOSTRATEG”, na podstawie umowy nr Gospostateg 1/385521/2/NCBR/2018”.
- Balassa, B. (1965). Trade Liberalization and Revealed Comparative Advantage. *The Manchester School*, Vol. 33, pp. 99-123.
- Bartczak, K. (2016). *Bariery rozwojowe handlu elektronicznego*. Wrocław: Exante.
- Fritz, M., Hausen, T., Schiefer, G. (2004). Developments and Development Directions of Electronic Trade Platforms in US and European Agri-Food Markets: Impact on Sector Organization. *International Food and Agribusiness Management Review*, Vol. 7, Issue 1, pp. 1-21.
- Gaffar Khan, A. (2016). Electronic Commerce: A Study on Benefits and Challenges in an Emerging Economy. *Global Journal of Management And Business Research*, Vol. 16, Issue 1, pp. 18-22.
- GUS (2019). Słownik pojęć. Handel elektroniczny. Retrieved from: <https://stat.gov.pl/metainformacje/sloownik-pojec/pojecia-stosowane-w-statystyce-publicznej/1778,pojecie.html> (access date: 24.06.2019).
- Henderson, J., Dooley, F., Akridge, J. (2000). Adoption of e-commerce strategies for agribusiness firms, Proceedings of the Americal Agricultural Economics Association Annual meeting, Tampa, FL, July 30-August 2.
- Laudon, K.C., Traver, C.G. (2017). *E-commerce 2017: Business, Technology, Society*. 13<sup>th</sup> ed. Pearson Education, Inc.
- Leroux, N., Wortman, S., Mathias, D. (2001). Dominant factors impacting the development of business-to-business (B2B) e-commerce in agriculture. *International Food and Agribusiness Management Review*, Vol. 4(2), pp. 205-218.
- Macneil, I.R. (1985) Relational Contract: What We Do and Do Not Know. *Wisconsin Law Review*, Vol. 4, pp. 483-526.
- Misala, J. (2011). *Międzynarodowa konkurencyjność gospodarki narodowej*. Warszawa: Polskie Wydawnictwo Ekonomiczne.
- Montealegre, F., Thompson, S., Eales, J.S. (2007). An Empirical Analysis of the Determinants of Success of Food and Agribusiness E-Commerce Firms. *International Food and Agribusiness Management Review*, Vol. 10, issue 1, pp. 61-81.
- Mueller, R.A.E. (2003). E-Commerce and Agricultural Commodity Markets, E-Commerce and Entrepreneurship in Agricultural Markets. *American Journal of Agricultural Economics*, Vol. 83(5), pp. 1243-1249.
- OECD (2002). *Measuring the Information Economy 2002*.
- PAP (2017). *Platforma do sprzedaży towarów rolnych – nowy projekt Ministerstwa Rolnictwa*. Retrieved from: <https://businessinsider.com.pl/finanse/handel/platforma-do-sprzedazy-towarow-rolnych-projekt-mr/3ehp8sf/>, 2.10.2017 (access date: 16.08.2018).
- Ploplis, E. (2018). *Dzięki Platformie żywnościowej sprzedasz produkty rolno-spożywcze przez Internet*. Rozmowa z wiceministrem Jackiem Boguckim, podsekretarzem stanu w MRiRW, agroFakt.pl, 28.03.2018. Retrieved from: <https://www.agrofakt.pl/handel-zywnoscia-przez-internet/> (access date: 25.06.2019).

- Porter, M.E. (2001). Strategy and the Internet. *Harvard Business Review*, Vol. 79(2), pp. 63-78.
- Strzębicki, D. (2015). The Development of Electronic Commerce in Agribusiness – The Polish Example. *Procedia Economics and Finance*, Vol. 23, pp. 1314-1320.
- Strzębicki, D. (2016). Czynniki rozwoju rynków elektronicznych B2B. *Handel Wewnętrzny*, Vol. 3(362), pp. 329-340.
- Szczepaniak, I. (2017). Krajowe i importowane surowce w produkcji żywności w Polsce. *Przemysł Spożywczy*, No. 4, pp. 2-5. DOI: 10.15199/65.2017.4.1.
- WITS-Comtrade: The World Integrated Trade Solution, Comtrade database. Retrieved from: <https://wits.worldbank.org/> (access date: 24.06.2019).
- WTO (2019). Electronic commerce. Retrieved from: [https://www.wto.org/english/thewto\\_e/minist\\_e/mc11\\_e/briefing\\_notes\\_e/bfecom\\_e.htm](https://www.wto.org/english/thewto_e/minist_e/mc11_e/briefing_notes_e/bfecom_e.htm) (access date: 24.06.2019).
- Xiaoping, Z., Chunxia, W., Dong, T., Xiaoshuan, Z. (2009). B2B E-Marketplace Adoption in Agriculture. *Journal of Software*, Vol. 4, pp. 232-239.

## IDENTYFIKACJA GRUP PRODUKTÓW REKOMENDOWANYCH DO WYMIANY HANDLOWEJ NA PLATFORMIE ŻYWNOŚCIOWEJ W ŚWIETLE OBROTÓW KRAJOWYCH I ZAGRANICZNYCH

### Abstrakt

*Elektroniczna platforma sprzedażowa produktów rolno-spożywczych może przyczynić się do poprawy sprawności i efektywności handlu żywnością oraz umocnienia pozycji Polski na rynku światowym. W Polsce, jak dotąd, brak było takiego rozwiązania, stąd Ministerstwo Rolnictwa i Rozwoju Wsi podjęło inicjatywę stworzenia elektronicznej platformy sprzedażowej pod nazwą „Platforma Żywnościowa”. Jej istota polegać będzie na kojarzeniu bezpiecznych transakcji kupna-sprzedaży. Celem artykułu jest identyfikacja grup produktów rekomendowanych do wymiany handlowej na Platformie Żywnościowej w świetle obrotów krajowych i zagranicznych. W opracowaniu zidentyfikowano branże polskiego przemysłu spożywczego, których udział jest najbardziej znaczący, oraz wyodrębniono produkty rolne szczególnie ważne dla polskiego rolnictwa, innymi słowy – wybrano sektory rolno-spożywcze, które potencjalnie mogą dostarczać produkty na platformę sprzedażową. W dalszej części wybór ten zweryfikowano w zakresie możliwości prowadzenia działalności handlowej na rynku światowym. Z przeprowadzonej analizy wynika, że grupami produktów rekomendowanymi do obrotów handlowych na Platformie Żywnościowej są: zboża, rzepak, cukier, owoce i warzywa, mleko, mięso czerwone oraz mięso drobiowe, wraz z ich przetworami. Wybór konkretnych produktów mogących być przedmiotem transakcji handlowych na platformie sprzedażowej będzie wynikał z dalszych szczegółowych analiz poszczególnych rynków rolno-spożywczych.*

**Słowa kluczowe:** Platforma Żywnościowa, produkty rolno-spożywcze, handel elektroniczny, przemysł spożywczy, rolnictwo.