ORGANIZATION OF FOOD SUPPLY CHAINS IN DISPERSED PRODUCTION ON THE EXAMPLE OF THE CEREAL SECTOR IN POLAND

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Abstract

The study presents the importance of cereal production in Poland. A diagram of the supply chain in agribusiness was presented. A graphical presentation of the flow of raw materials and cereal products from primary producers (producers of raw materials and means of production for agriculture) to the consumer was developed. Trends of changes in the cereal sector and their products, which occur after economic transformation, are presented. It was found that the logistics chain for the supply of cereal and its products includes over one million cereal producers, tens of thousands of agri-food processing units, agricultural trade, wholesale and retail food trade. It must be flexible, adapting to new challenges. The condition for success in the conditions of dispersed production of raw materials is the efficiency of chain management as well as solidarity and mutual trust of participants.

Keywords: Logistics, agriculture, food industry, agricultural trade

1. INTRODUCTION

Cereal are one of the most important agricultural products in Poland and in the world. In 2016 its value constituted 16.2 % of Polish global production and 11.3 % production of goods [1]. In 2017 31.8 million tonnes were collected, while 37.1 million tonnes (This is the volume greater than the annual production of copper ore (32.8 million tons), and was equal to 56.4 % of hard coal mining (65.8 million tons)) were available at the disposal of resources and imports [2,3]. Poland is an important producer of cereal on a European (In 2017, Poland participated in 0.2 % of area and 0.6 % of the world's population, but in 17.0 % of rye production, 2.4 % of barley and 1.4 % of wheat. In the case of participation in the European Union, these numbers are respectively: 1.4 % of land, 5.2 % of people, 19.9 % of rye (in 2010 even 27.8 %), 3.9 % of barley and 4.3 % of wheat.) and global scale [3].

Cereals play a very important role as a source of income for producers, the basis of food and in creating jobs. They are the basic raw material in many industries such as the milling, spirit, bakery, brewing, confectionery and renewable fuels industries. They are the basic feed for livestock. The weight of production and the large number of producers and processors causes the growing interest of producers and traders in the efficiency of purchase and flow of cereal and its products, as well as the functioning of logistics chains. The aim of the study was to identify the supply chains used in agribusiness, especially in the trade of cereals and its products, as well as the trends of changes taking place in this sector. The research used available mass statistics data, data prepared by Institute of Agricultural and Food Economics - National Research Institute (IAFE-NRI) and literature on the subject.

2. TRENDS IN GLOBAL AND DOMESTIC CEREAL PRODUCTION

In the international statistics cereals are disclosed in two groups (In 2016/2017, global wheat harvest amounted to 750 million tons, and fodder crops 1078 million tons. Cereal market, condition and prospects): wheat and feed grains [2]. Wheat is grown on the largest scale in the Commonwealth of Independent States, the Americas, the European Union and East Asia. The largest producer is the European Union, however, in the years 2000 - 2015, the size of collections increased much faster in African countries (by 48.4 %), East Asia

(34.6 %) and South Asia (31.6 %), and the global collections increased by 23.6 % [4]. The production of feed grains grew the fastest in South America (by 88.1 %), East Asia (80 %) and Southeast Asia (66.6 %).

In Poland, the area of cereal sowing since 1990 has been steadily decreasing, from over 14 to 11 million ha, in recent years has stabilized. In 2013 - 2018 cereal crops grew by 7.1 %, although the directions and pace of changes varied [2]. Maize grains increased the most (over 2.5 times) and wheat (1.7 times).

3. TYPICAL SUPPLY CHAIN IN AGRIBUSINESS

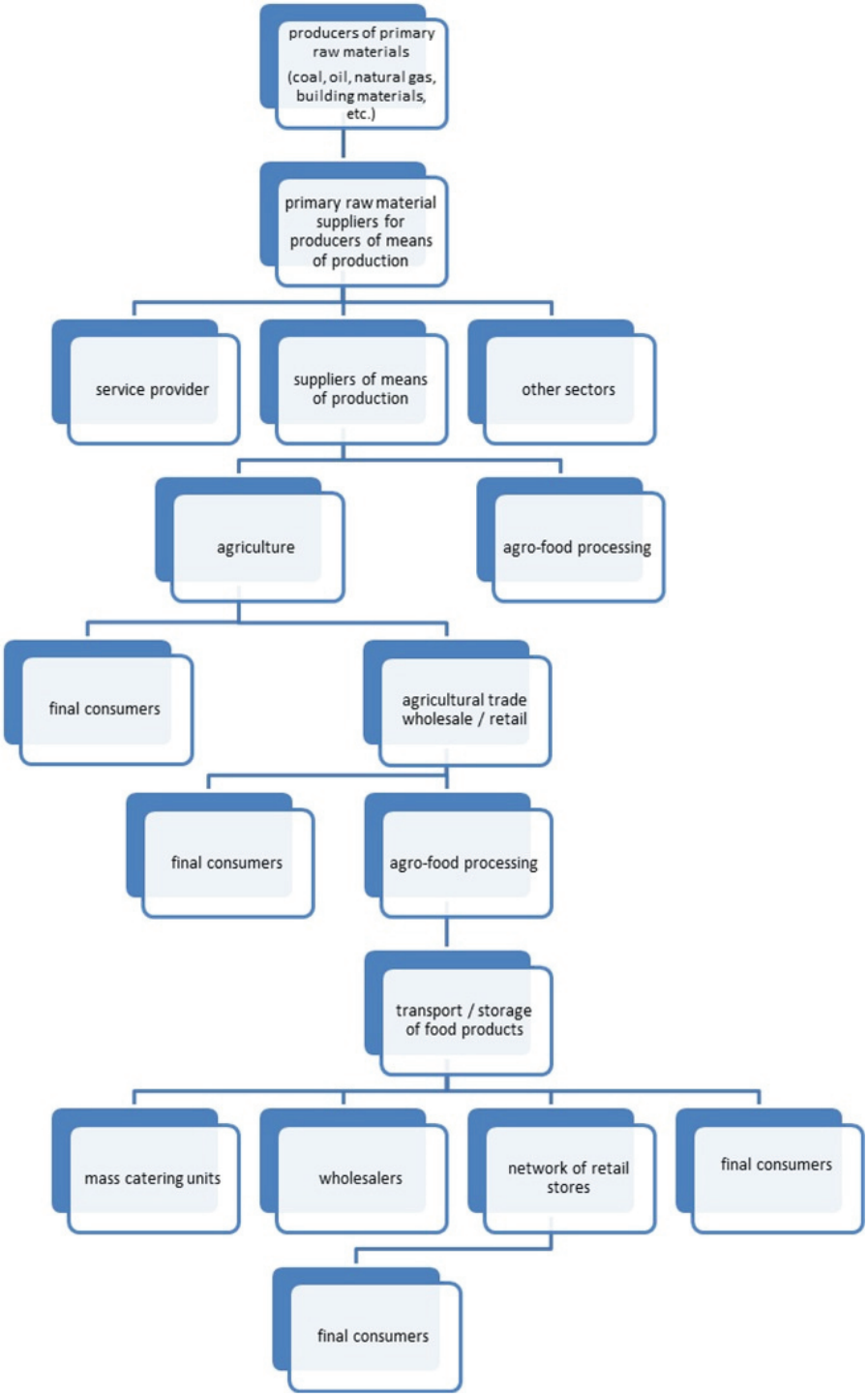

Figure 1 Generalized scheme of food supply chains [own study]

The logistics supply chain is the next stage of the entire process of the flow of goods and services from the producer to the consumer. Such chain can be of various length and depth, so it can start with producers of primary raw materials for the entire production (eg oil, coal, etc.), or from a specific chain link. Regardless of their length, all operations and processes must be organisationally and financially coordinated.

In a typical logistics chain there are many processes related to production management, inventory, demand, order fulfillment and purchases [5]. Therefore, we deal with such links as: obtaining raw materials (eg extraction), supply of raw materials and semi-finished products, production as well as distribution of finished products to the customer. Logistic chain is a network that extends between the supply and sales markets, manufacturers, suppliers, commercial and logistic units, and final recipients [6]. It covers the flow of goods, information and financial resources.

The basic principles and organizational forms existing in logistic chains are also valid in food flows. The organizational chart common to almost all agribusiness chains is presented in the **Figure 1**.

4. FLOWS OF CEREALS AND ITS PRODUCTS

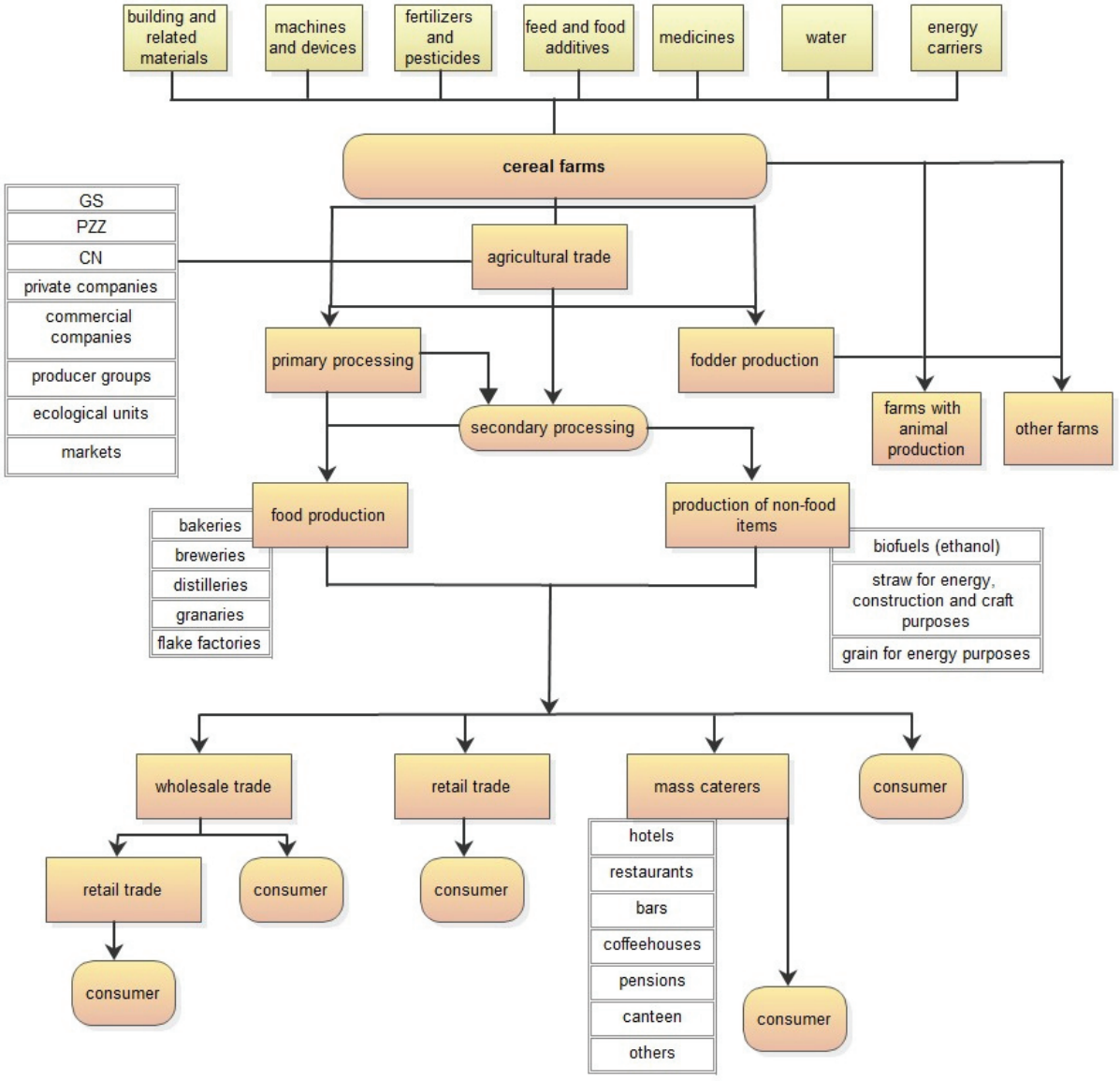

Figure 2 Supply chain pattern cereals sector [own study]

Within the framework of agribusiness there are many logistic chains concerning individual agricultural raw materials. As the most important one can indicate chains: grain, milk, beef, pork, fruit and apples. Primary products in agriculture (raw materials) are: grains of cereals, green fodder, roots and tubers of root plants, seeds of oil and legume plants, fruits and vegetables [7]. Agricultural cereals are of decisive importance for the scale of agricultural production, as a basis for processing inside and outside farms, in agri-food processing. In the area of cereals, farming is both - a manufacturer and a consumer. For example, in 2017, this sector allocated 61.1 % to fodder, another 6.3 % for sowing - two thirds of total cereal consumption [2]. 10.4 % of this consumption was allocated to industrial processing, but it plays an important role in the production of food products.

Food products can be extracted from cereal as raw material directly or indirectly. The first group includes milling products, bakery and flour products as well as animal feed. Their share in the sale of food products reached 21.1 % [8]. Cereals are also a raw material product for the production of meat and milk (47.5 % of sales), as well as other articles (15.8 %, including starch, many beverages such as vodka or beer, etc.). It can therefore be concluded that cereals have their direct or indirect contribution to more than 80 % of the sold production of groceries in Poland. The importance of this product means that its movement and processing must take place in the operational links of many networks of connections. More important supply chain processes and their links are presented in **Figure 2**.

The cereal supply chain begins with producers and suppliers of means of production (In the presentation of logistics chains of agricultural raw materials and their preserves, the authors usually omit the link of producers and suppliers of raw materials and production means for agriculture. However, the authors consider this to be an incorrect approach, because modern agriculture depends on the quantity, quality and timeliness of their deliveries to the same extent as industrial or commercial enterprises.), such as agricultural machinery and tools, construction materials, energy carriers, fertilizers, plant protection chemicals, animal feed, medicines, seed and seed, etc. Therefore, you can look for the roots of the chain already in mines, machinery factories, chemical plants, and also in other farms. This indirectly indicates how great the recipient / buyer of industrial and own production is the agricultural sector.

The agricultural production itself takes place in a large number of relatively small farms (In 2010, there were about 1.5 million households in Poland compared to 2.1 million in 2003, and the average area increased from 6.6 ha to 9.6 ha. For comparison, in 2010 there were 299,000 in Germany. farms (average 55.8 ha), France - 516 thousand. (53.9 ha), Great Britain 227 thousand. (70.8 ha), and the Czech Republic, 22.9 thou. (152.4 ha)), hence it is very dispersed and requires a good system of connections between cereal producers and recipients, good organization of transport and storage [9]. The number of farms is falling, both total and cereal producers. The latter in 2005 in Poland was nearly 1.7 million, in 2013 - 1.1 million and in the year 2016 to 1065 thousand, the decrease was 37 % [10].

The tendency to reduce the number of producers in Europe is most affected by the countries in which the 1990s underwent a transformation. In Poland, after 2005, 34.0 % of producers lost, and in the Czech Republic - 32.9 %. Slightly slower are these processes in the countries of Western Europe, where concentration of production took place in previous decades.

Cereal flows for processing take place through many channels. The simplest relationship is: producer - processor, or farm - mills, granaries, distilleries, breweries, etc. This type of supply is already present, but it mainly concerns producers of large lots of cereal or producer groups. Most farmers produce smaller quantities of cereal, hence they use intermediaries (The average area of cereal cultivation on the holding in 2016 was 6.95 ha), such as Polskie Zakłady Zbożowe, Centrala Nasienna, Gmina Spółdzielnia, commercial companies and private units more often [10].

5. TRENDS IN CHANGES IN THE ORGANIZATION OF CEREAL SUPPLY CHAINS AND THEIR PRESERVES

The transformation of the Polish economy and integration with the European Union have had a very large impact on the changes in the Polish cereal sector. They included the plane of production and economic organization. The following are the most important tendencies:

1) a declining number of agricultural producers and an increase in the scale of production in other,
2) technology and standardization of production imposed on farmers,
3) increasing precision in the performance of agro- and zootechnical works, including the use of pesticides,
4) wholesale supplies of revolving production means for producers,
5) the growing role of outsourcing in agriculture, especially in the field of cereal trading,
6) consolidation processes and decrease in the number of cereal trade units,
7) reducing the role of local market-oriented trade,
8) growing sizes of processing plants and their consolidation,
9) reducing the number of intermediary links in the chain,
10) technological progress and growing technological / hygiene regime in processing,
11) deepening processors' links with large-area retail trade,
12) reducing the role of small industrial processing units,
13) the appearance of small factories and half-craft sales units,
14) return to traditional products (beer, bread),
15) significant progress in the field of transport and storage infrastructure.

6. CONCLUSION

1) The cereal sector is one of the most important in Polish agribusiness, and its operation is an important factor determining the economic situation of many economic entities in and outside agriculture.
2) The logistics chain of cereal deliveries and its products is very extensive, covers over one million cereal producers, tens of thousands of agri-food processing units, agricultural trade, wholesale and retail food trade. It must be flexible, adapt to new challenges related to technological and organizational progress and changes taking place in the agribusiness and customer environment.
3) Agriculture for many centuries functioned in some functional isolation from the rest of the economy. Today, it is a full-fledged member of the food and national food economy complex. The individual links of the chain are joined by the community of economic interests, both short-term (season, year) and strategic.
4) The condition for success in supply chains in the conditions of dispersed production of raw materials is the efficiency of their management and equally solidarity and mutual trust of producers, traders, processors, consumers, recognition that each participant in the chain gains in a similar range.

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