

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

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Abstract. The study presents a diagram of the supply chain in agribusiness prepared by the authors. A graphical presentation of the flow of raw materials and fat products from primary producers (producers of raw materials and means of production for agriculture) to the consumer was developed. Trends of changes in the production of rape and its products, which occur after the economic transformation, are presented. It was found that the logistics chain for the supply of rape and its products includes thousands of farmers, 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 the participants.

Key words: logistics, agriculture, oil industry, oilseed rape, vegetable oils.

JEL code: Q11, Q13, R40, R41.

Introduction

Oilseed plants are becoming one of the most important agricultural products in Poland and in the world. Globally, there are several important plants of this group, such as: soybean, cotton, peanuts, rapeseed, sunflower, palm kernels, copra, flax, sesame and castor oil (Wittkop B., Snowdon R.J., Friedt W.) Their global collections in 2017 were estimated at 562.7 million tonnes. In Poland, the basic oily plant was rapeseed, belonging to the category of industrial crops, whose value in 2016 was 6.9 billion zlotys, that is 6.69 % of Polish global agricultural production and 6.73 % of commodity production (Central Statistical Office, 2017). In 2017, 2.7 million tonnes of rapeseed were collected in Poland, while 3.2 million tonnes were available at the disposal of resources and imports (IAFE-NRI, 2018). Poland was the third producer of rape on a European scale, more is produced only by France (5.2 million tonnes in 2017) and in Germany (4.3 million ha) (IAFE-NRI, 2018).

Rapeseed is important as a source of income producers (on good soils and medium-sized), and in creating jobs. It is the basic raw material in the oil industry (traditionally) and - more and more widely in the production of renewable fuels. Waste from processing is used as a component in the production of feed (grits) for livestock.

The importance of production and the increasingly promising prospects for using rapeseed for non-consumer purposes, but also energy (Sambra A., Sørensen C.G., Kristensen E.F., 2009), as well as a relatively favorable level of profitability of this activity compared to other plants triggers farmers' interest in rape cultivation (Elbehri A., Hoffman L., Ash M., Dohlman E., 2001). The significant number of producers and processors results in the growing interest of farmers, oil companies and salesmen in the efficiency of purchase and flow of grain and its products, that is the functioning of logistics chains (Rokicki T., 2013). The aim of the study was to identify the supply chains used in agribusiness, especially in the trade of oilseed rape and its products, as well as the trends of changes taking place in this sector. The studies used available mass statistics data - Central Statistical Office, data prepared by Institute of Agricultural and Food Economics - National Research Institute (IAFE-NRI) and literature on the subject.

From the produced vegetable oils (about 190 million t in the 2017/2018 season), the most important item was palm oil (about 70 million t), then soybean oil (55.6 million t), rapeseed (25.8) and sunflower oil

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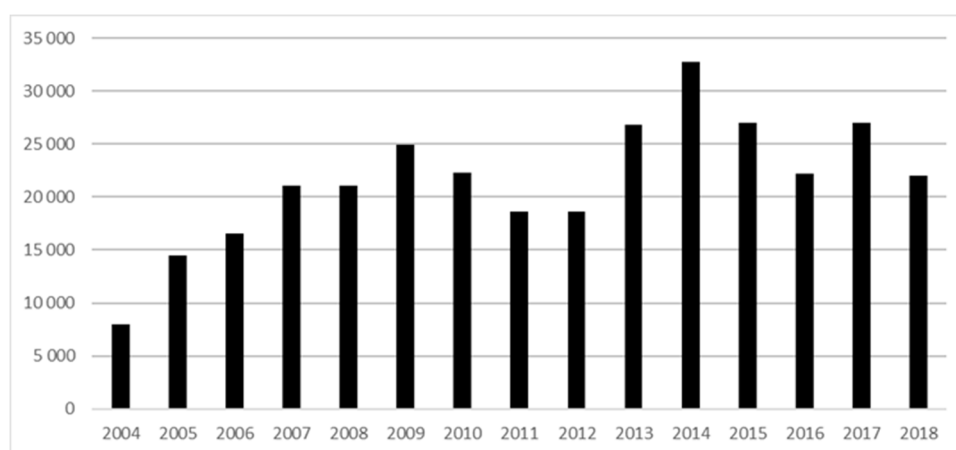
(18.9). The most important eight oils are palm kernel oil (7.5), cotton (4.5), arachis (4.0) and coconut oil (2.8 million tons).

Trends in global and domestic production of oilseeds

The most important oil plants in the world are just three species. The global seed production in 2017/2018 amounting to 562.6 million tonnes as high as 338.3 million tonnes (60.2 %) was soybeans, 66.4 million tonnes (11.8 %) oilseed rape and 49.7 million tonnes (8.8 %) sunflower (IAFE-NRI, 2018). Their collections show a certain variability. For example, soybean production in 2017/18 decreased by 2.7 % compared to the previous season, and in the next (according to forecasts), it will grow by 5 %. The same was true for sunflower seeds (corresponding figures were -0.6 % and 3.3 %), while in the case of rapeseed, it was the reverse (5.0 % and -3.3 %). Soybean production has been invariably dominated by US and Brazil agriculture (about 120 million tonnes) for years, followed by Argentina (with an upward trend, up to a projected figure of around 50 million tonnes in 2018/2019) and China (over 15 million tonnes). Canada and the European Union (about 20 million tons) are a powerhouse in the production of rapeseed. The major producers include India, China, Ukraine, Russia and Australia. The production of sunflower is distinguished by countries such as Ukraine, Russia, China and Turkey.

In the European Union, the size of oilseed crops is determined by the rapeseed harvest, the remaining plants are marginal or non-existent. In turn, in the production of rape, besides France, Germany and Poland, the major producer was Great Britain (2.1 million tonnes) Romania (1.8) and the Czech Republic (1.1 million tonnes) (IAFE-NRI, 2018).

In Poland, the area of rape cultivation prior to integration with the European Union was about 0.4 million ha, but after accession it quickly increased, even more than twice, to around 0.9 million ha. The yields also increased (from 2.1 to 2.8 t/ha), which together resulted in an increase in the harvest of rapeseed from 0.9 to 2.5 million tons (IAFE-NRI, 2018). From this in Poland, about 1.4 million tons are needed for food purposes. This means that on average, it is possible to allocate (variable) seeds for processing for energy purposes every year (Figure 1).



Source: author's calculations based on the Central Statistical Office data 2004-2018

Fig. 1. Rapeseed production in Poland in 2004 - 2018 (thousand tonnes)

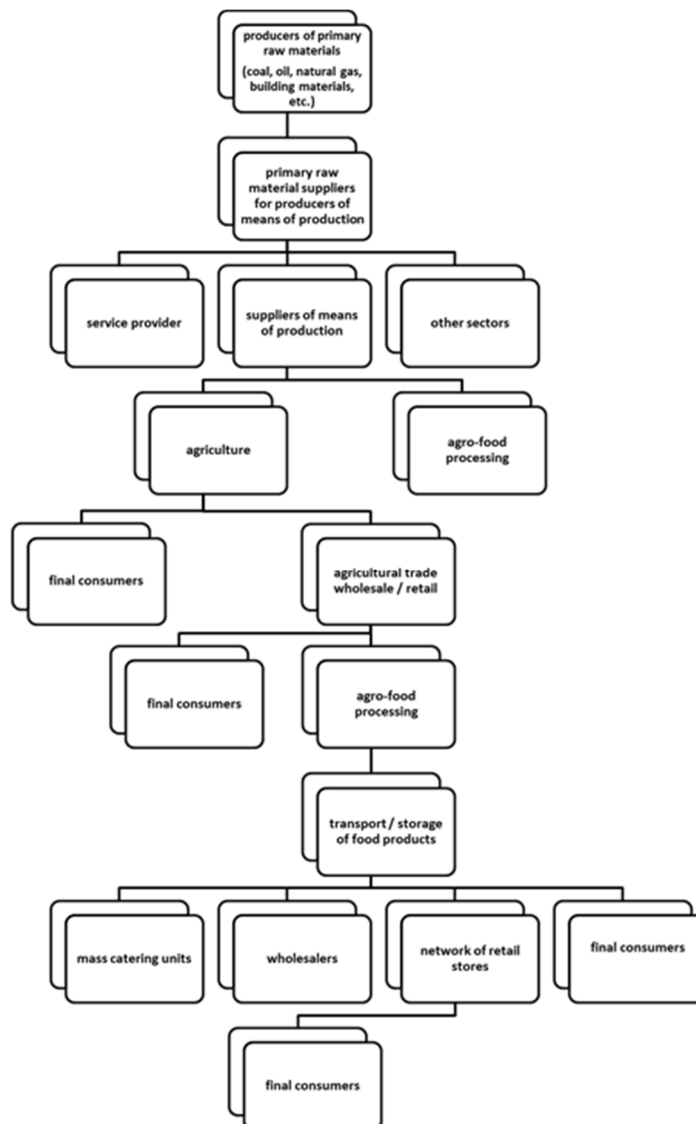
The cultivation of rapeseed in Poland is spatially diversified, as farms from Western and Northern Poland dominate here. It can be briefly stated that rapeseed is grown more widely in areas where there used to be a lot of state-owned farms, and now larger farms dominate. In seven western provinces (for 16 in Poland), the proportion of rapeseed in sowings accounted for more than 10 %, and in three of them even more than 16 %.

Typical supply chain in agribusiness

The logistics supply chain means the subsequent stages of the entire process of the flow of goods and services from the producer to the consumer. Such a chain can be of various length and depth, and thus start with primary raw material producers for the entire production (e.g. oil, coal etc.) or from a specific chain link. Regardless of their length, all operations and processes must be coordinated in organization and financially.

In a typical logistics chain, there are many processes related to production management, inventory, demand, order fulfilment and purchases. Therefore, we deal with such links as: obtaining raw materials (e.g. extraction), supply of raw materials and semi-finished products, production as well as distribution of finished products to the customer. The logistics chain is a network extending between the supply and sales markets, producers, suppliers, commercial and logistic units, and final recipients (Klepacki B., Jarzeowski S., 2000). 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 shown in Figure 2.



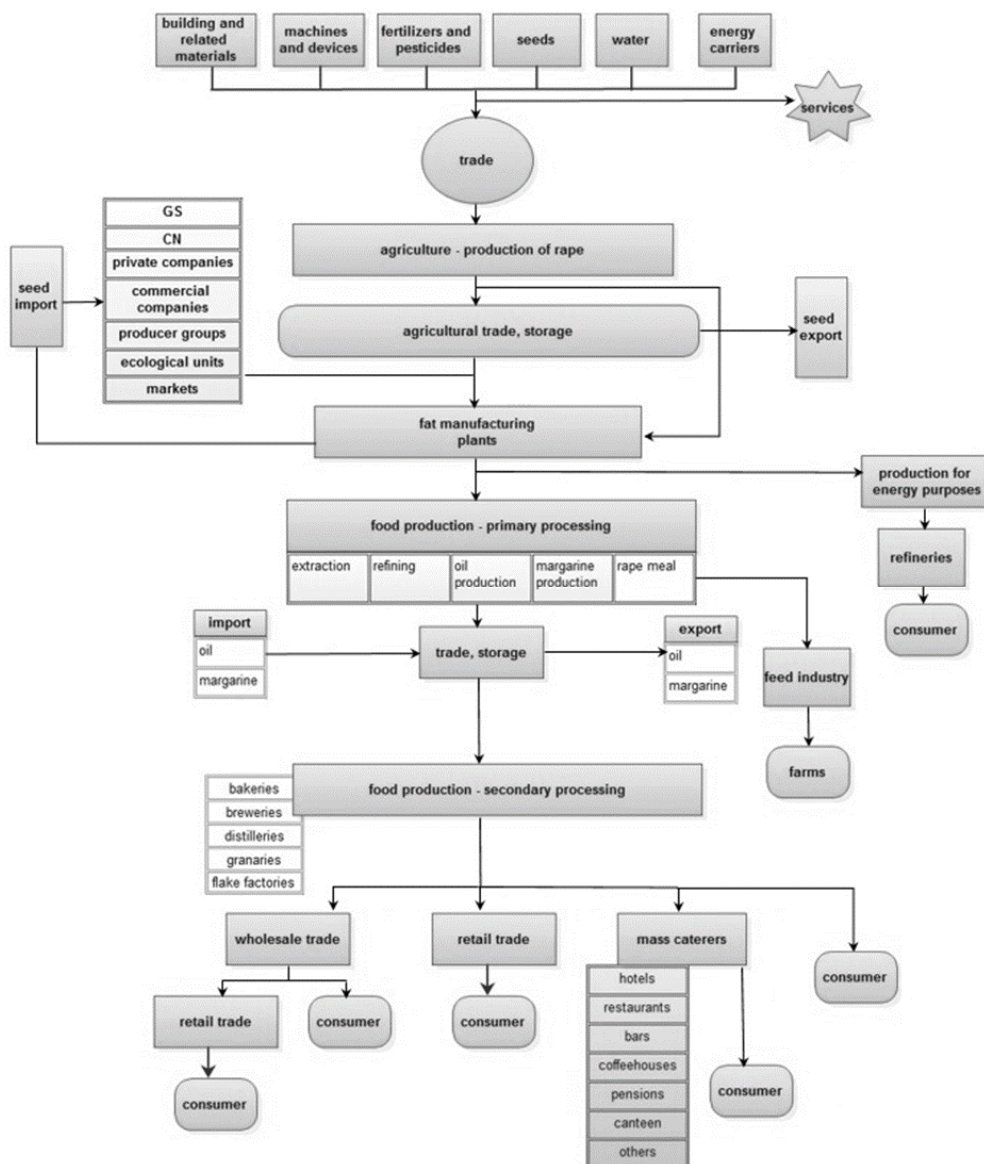
Source: developed by authors

Fig. 2. Generalized scheme of food supply chains

Rapeseed and oil products flow

Within the framework of agribusiness there are many logistic chains concerning individual agricultural raw materials. As the most important one can indicate chains: grain, oilseeds and their products, milk, beef, pork, fruit and vegetables. Primary products in agriculture (raw materials) are: cereal grains, seeds of oil and legume plants, grass grasses, roots and tubers of root crops, fruits and vegetables. Agricultural grains are decisive for the scale of agricultural production, however, all products, including oilseeds, are important. In contrast to cereals, for which agriculture is both a producer and a consumer, in the case of rapeseed it is primarily a producer, to a small extent a consumer (only seeds for sowing).

Food products can be obtained from rape as a direct or indirect material. The first group includes milling products, or ground meal as animal feed. Their share in consumption is minimal. Rape as an intermediate supplier plays a more important role, being a source of raw material (fat) for the production of oils and margarines. The importance of this product means that its movement and processing must take place in the operational links of many networks of connections (Klepacki B., 2000). The main processes of the rape supply chain and their links are shown in Figure 3.



Source: developed by authors

Fig. 3. Supply chain pattern oilseed market

The rapeseed supply chain begins with producers and suppliers of means of production³, such as agricultural machinery and tools, construction materials, energy carriers, fertilizers, plant protection chemicals, animal feed, medicines, seed and seed, etc. It is possible to look for the „roots“ of the chain already in mines, machinery factories, chemical plants, but also in other farms. This indirectly indicates how great the recipient / buyer of industrial and own production is the agricultural sector.

Agricultural production takes place in a large number of relatively small farms, hence it is very dispersed and requires a good system of connections between grain producers and recipients, good organization of transport and storage (Leao R.R.D.C.C., Hamacher S., Oliveira F., 2011). In contrast to other activities in agriculture, the number of rapeseed producers has not decreased, but increased from 43 to 90 thousand, more than double. This proves the growing interest of farmers in the production of rape. It is worth noting that the number of total farms has decreased from 2.0 to 1.4 million, or 30 % (IAFE-NRI, 2018).

Rapeseed flow for processing takes place through many channels. The simplest is the relationship: producer - processor, the farm - Oil industry plants etc. (Hobbs, J.E., Young L.M., 2000). This type of supply already exists, however, concerns mainly manufacturers of large batches of rape or producer groups. Many farmers produce smaller quantities of rapeseed and use the services of intermediaries, such as commercial companies and private entities.

Trends in the organization of supply chains oilseeds and their products

Socio-political changes and accession to the European Union influenced the Polish oil sector in both production and structural aspects. The most important trends can be regarded as follows:

- the decreasing number of farms in Poland was accompanied by the growing number of rapeseed producers and the increasing scale of its production (Carre P., Pouzet A., 2014);
- the role and strength of direct connections between the processing industry and seed producers has increased, which is expressed among others by imposing production technologies on farmers, the number of intermediary links in the oil chain is decreasing;
- precision in the application of technological requirements increases, especially in the use of chemicals;
- outsourcing services for farmers are being developed, especially in the field of seed marketing, but also wholesale supply of revolving production means;
- consolidation processes are progressing and the number of grain and rapeseed units is decreasing, while local marketplace trade has been marginalized;
- the size of processing plants grows and their consolidation;
- there has been significant technological progress and increased requirements in the field of technological and hygienic regime in food processing (Sporleder T.L., Goldsmith P.D., 2003) including oilseed processing;
- there was a decrease in the role of small processing units, practically eliminating small oil mills;
- there has been significant progress in the field of transport and storage infrastructure on the national scale, which means that logistics costs in individual terms are decreasing.

Conclusions, proposals, recommendations

- 1) The oilseed sector is one of the most important in Polish agribusiness, and its functioning is an important factor determining the economic situation of many economic entities in agriculture and beyond.

³ 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 erroneous approach, because modern agriculture depends on the quantity, quality and timeliness of their deliveries to the same extent as industrial or commercial enterprises.

- 2) The logistics chain for the supply of rape seeds and its products is very extensive, it includes thousands of rapeseed producers, agri-food processing units, agricultural trade, wholesale and retail food trade. It must be flexible, adapt to new challenges related to the technological and organizational progress and changes taking place in the agribusiness environment and among clients.
- 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. Individual links of the chain are connected by a community of economic interests, both short-term (season, year) and strategic.
- 4) The condition of 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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