

Global consumer trends for sustainable milk and dairy production

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Abstract

World production of milk and dairy products is characterized by stable growth dynamics. It has been established that the quality of incoming raw materials, the specialization and organization of the technological process, as well as the peculiarities of the functioning of the food market have a great influence on the creation of sustainable production of milk and dairy products. Herewith, the development of the market for milk and dairy products is influenced by global consumer trends, such as the growing attention to health care, passion for sports, an active lifestyle and healthy eating. This led to the formation of a market demand for new product formats designed to meet the specific needs of individual consumer groups. The article gives an assessment of the dynamics of world milk production by types, regions, exports and imports of milk and dairy products, and provided forecast of world production and exports of dairy products. The results of the performed analysis are necessary to assess the state and development of the dairy industry in the context of global trends, promising areas for sustainable production and its effective functioning, as well as potential opportunities for cooperation between countries. The most important areas of sustainable production should be further expansion of the market capacity of dairy products by increasing its range, expanding economic and physical accessibility, implementing targeted programs to ensure healthy nutrition of the population, as well as increasing export and logistics potential through effective integration into the global market space.

Keywords: sustainable production, milk and dairy products, consumer trends effective integration, global market, cooperation, effective functioning.

Introduction

The global market for milk and dairy products is formed under the influence of established trends and continues its development. At this stage, the world milk market is undergoing significant transformations based on changing consumer preferences and the demographic situation. An important role in providing the population with food belongs to the functioning and development of the dairy industry (includes fodder production, dairy cattle breeding, dairy

industry, production infrastructure, sale of milk and dairy products, social infrastructure), engaged in the production, processing, marketing of milk and dairy products (Gusakov, V. G., 2020).

Modern digital technologies are being introduced to the agri-food sector, including the dairy industry based on new-generation intelligent automated and robotic biomachine complexes (creating a smart dairy farm, using drones to monitor animals, collar technology

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for assessing the state and level of productivity, etc.) (Volkova, E.V., 2020).

1. In accordance with the Food and Agriculture Organization's Concept of Work in the field of sustainable food production, "... agriculture is considered sustainable when it meets the needs of present and future generations, ensuring both profitability and the maintenance of the environment and socio-economic equity. Sustainable food production and agriculture contributes to the improvement of the main components of food security (availability, accessibility, use and stability) in three types of sustainability: environmental, social and economic" (Sustainable food production and agriculture, 2022).

The allocation of the dairy industry as an independent structure not only gives special importance to the problem of providing the population with milk and dairy products, but also allows it to be solved in accordance with the requirements, preferences of consumers

Material and methods

The methodological tools of the researched problem are based on dialectical methods of cognition, which ensure the complex and objective nature of their study. In the process of collecting and processing information, such general scientific methods of cognition as systematic and comprehensive analysis and synthesis, comparison, formalization and modeling were used. Methods of graphical and economic-statistical analysis using the economic-mathematical apparatus were used during the study.

On the world market (Western European countries and the USA), there is an increase in consumer interest in vegetable analogues of dairy products, which are associated with a healthier lifestyle. In order to increase the efficiency and competitiveness of milk processing organizations, attention is constantly paid to the development and

and national traditions. This structural unit corresponds to the internationally accepted Food and Agriculture Organization classification of commodity subgroups – milk and dairy products in terms of milk.

Milk is one of the key food products of the food supply of the population that is in demand by all its segments, and the dairy industry at this stage is one of the leading sectors in the food industry, the development of which is of strategic importance for each country. Providing the population with affordable and high-quality dairy products is one of the main areas of socio-economic significance (Volkova, E.V., 2020., Efimenko, A.G., Efimovich, V.V., 2021., Efimenko, A.G., Mitskevich, B., 2020).

The purpose is to study the main trends in the modern development of the world production of milk and dairy products and to develop promising directions for its development, taking into account the features, conditions and factors.

implementation of modern innovative technologies, food recipes, updating and expanding the range of dairy products, increasing the production of new, innovative types of food products with improved consumer properties (dairy products enriched with iodine, bifidobacteria, a vitamin complex, fruits, vegetables) and longer shelf life. It is concerned with products for sports nutrition and consumers with certain physiological needs (production of lactose-free milk, powdered infant formula based on goat's milk, dairy and cheese snacks, production of ecological and functional products, etc.). It is predicted that by 2025 the global market for functional foods (milk phospholipids, galactooligosaccharides, collagen proteins, Omega 3, vitamins B, A and D) will reach 275 billion US dollars with an average annual growth rate of approximately 8%.

Results and discussion

The dynamics of world milk production and its growth rate are presented in Figure 1.

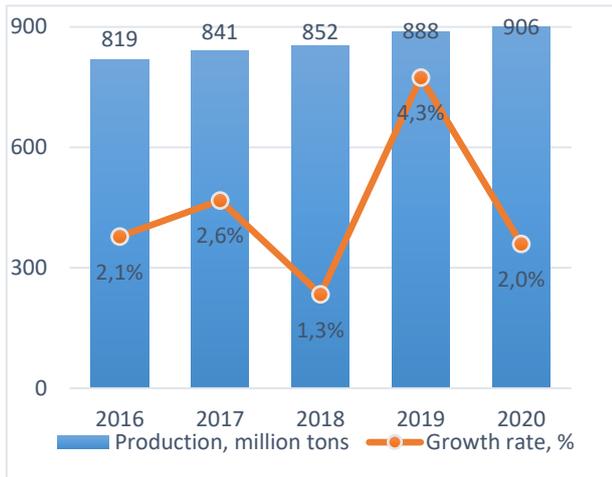


Figure 1. Dynamics of world milk production and its growth rate

Source: suggested by the author

The data presented in Figure 1 shows that in 2020 the world milk production amounted to 906 million tons (in value terms it is 711 billion US dollars), which is 2.0% higher than in 2019, compared to 2016 – by 10.6%. During 2016–2020, average world dairy production has increased by about 2.5% annually.

The structure of world milk production by region in 2020 is presented in Figure 2.

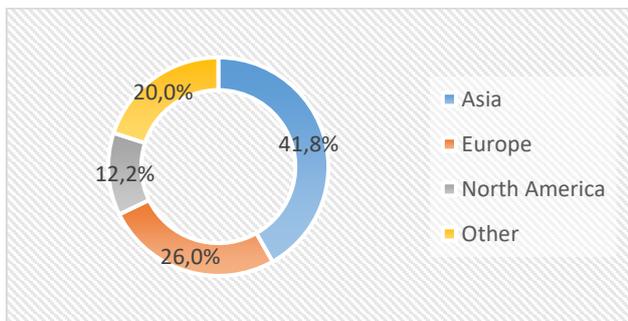


Figure 2. Structure of world milk production by regions

Source: suggested by the author

The data presented in Figure 2 shows that in 2020 the largest share in the overall structure of world milk production by region belongs to the countries of Asia (41.8%), Europe (26.0%) and North America (12.2%), other countries (20.0%). An increase in milk production is observed in South America (about 8% annually).

The analysis also showed that in the total volume of world milk production by type, cow’s milk occupies the largest share – 81%, buffalo milk – 15%; goat, sheep and camel milk – about 4%.

Let’s fulfill the forecast of world milk production for the period up to 2025. Let’s build a trend equation; to this end, we choose a linear growth curve, since it more accurately repeats the dynamics of the original time series (Figure 3).

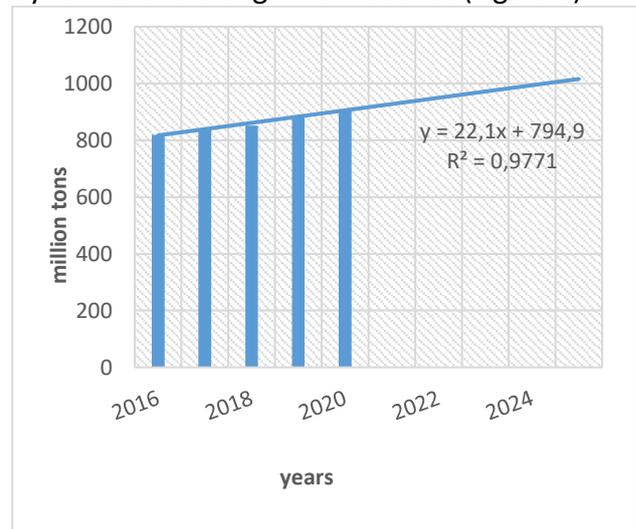


Figure 3. Forecast of world milk production, million tons

Source: suggested by the author

Using the equation obtained on the graph, we calculate the forecast for the world volume of milk production (Table 1).

Table 1. Forecast of world milk production

Name	2021	2022	2023	2024	2025	Growth rate, 2025/2021, %
World milk production, million tons	882.5	904.6	926.7	948.8	970.9	110.02

Source: build by the author

Calculations showed that the growth rate of world milk production by 2025 will be 10.02%

compared to 2021, which reflects a positive trend.

The dynamics of the world volume of exports and imports of milk and dairy products is presented in Figure 4.

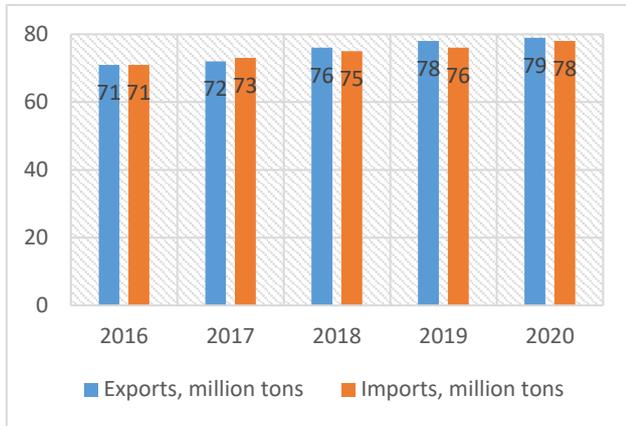


Figure 4. The dynamics of the world volume of exports and imports of milk and dairy products

Source: suggested by the author

The data presented in Figure 4 shows that in 2020 international trade in dairy products amounted to 79 million tons in terms of milk, which is 1.3% higher than in 2019. The average annual growth rate of exports of milk and dairy products for the study period was 2.6%.

The structure of exports of world production of milk and dairy products by region for 2020 is presented in Figure 5.

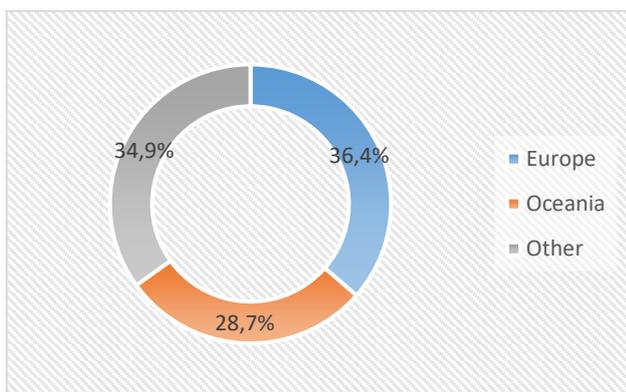


Figure 5. The structure of exports of world production of milk and dairy products by region

Source: suggested by the author

The data presented in Figure 5 shows that in 2020 the largest share in the total structure

of world exports of milk and dairy products is occupied by the countries of Europe and Oceania – 36.4% and 28.7%, respectively.

Let’s fulfill the forecast of world exports of milk and dairy products for the period up to 2025. Let’s build a trend equation; to this end, we choose a linear growth curve, since it repeats the dynamics of the original time series more accurately (Figure 6).

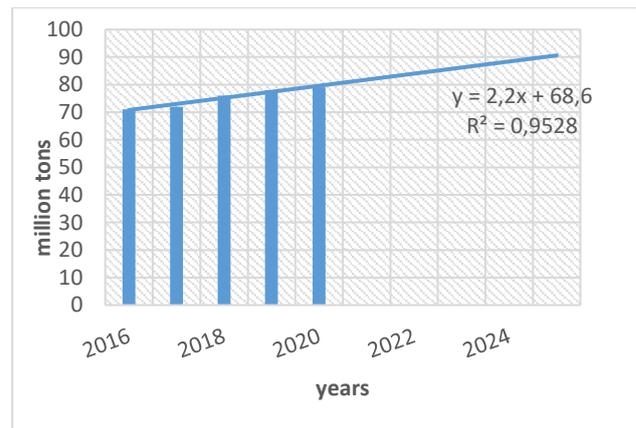


Figure 6. Forecast of world exports of milk and dairy products, million tons

Source: suggested by the author

Using the equation obtained on the graph, we calculate the predicted value (Table 2).

Table 2. Forecast of world exports of milk and dairy products

Name	2021	2022	2023	2024	2025	Growth rate, 2025/2021, %
Export of milk and dairy products, million tons	82	84	86	88	91	110.9

Source: build by the author

Calculations showed that the growth rate of world exports of milk and dairy products by 2025 will be 10.9% compared to 2021.

The structure of imports of world production of milk and dairy products by region for 2020 is presented in Figure 7.

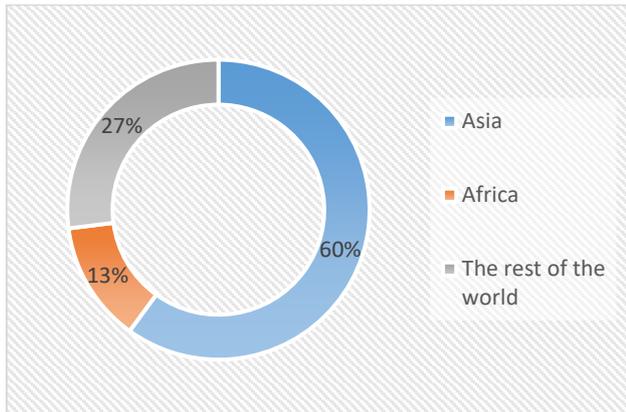


Figure 7. The structure of imports of world production of milk and dairy products by region

Source: suggested by the author

The data presented in Figure 7 shows that in 2020, global imports of milk and dairy

products amounted to 77.6 million tons, which is 1.5% higher than in 2019. The largest share in the total structure of world imports of milk and dairy products is occupied by the countries of Asia and Africa – 60% and 13%, respectively.

In the overall structure of world cheese production in 2020, the largest share is occupied by the countries of the European Union (approximately 50%), the USA (25%), Russia, Brazil and Argentina (Market overview of milk and dairy products of the Republic of Belarus, Electronic resource, 2022).

The dynamics of world production and consumption of cheese is presented in Figure 8.

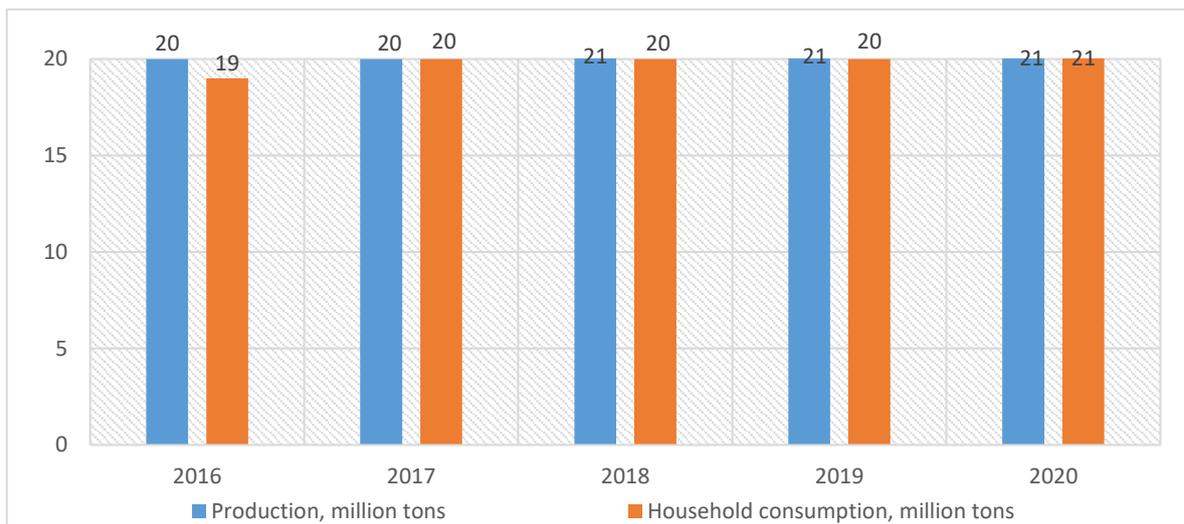


Figure 8. The dynamics of world production and consumption of cheese

Source: suggested by the author

The data presented in Figure 8 shows that the world production of cheese in 2020 amounted to 21 million tons, which is 5% higher than in 2016. On average, over this period, world cheese production increased annually by 1.7%.

In the structure of world cheese exports, the leading position is occupied by the countries of the European Union (about 40%), the USA (16%) and New Zealand (15%). The Republic of Belarus is one of the five largest cheese exporters in the world, occupying

about 12% of world cheese exports. In the structure of world cheese imports, the leadership belongs to Russia and Japan (about 41%). The demand for cheese is growing in China and South Korea: on average, for 2016–2020, the volume of cheese imports increased by 6.8% and 4.5%, respectively (Market overview of milk and dairy products of the Republic of Belarus, Electronic resource, 2022).

The dynamics of world exports and imports of cheese is presented in Figure 9.

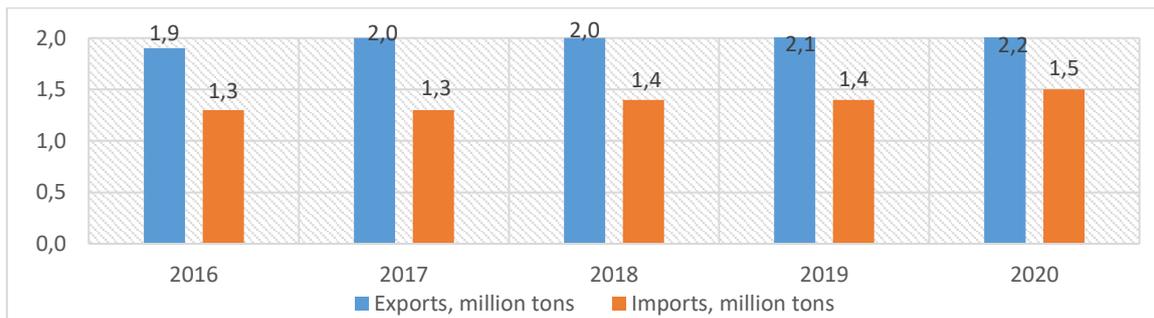


Figure 9. The dynamics of world exports and imports of cheese

Source: suggested by the author

The data presented in Figure 9 shows that for 2016–2020, world cheese exports increased by an average of 3% annually and amounted to 2.2 million tons in 2020, the volume of imports – 1.5 million tons.

In the overall structure of world production of butter, the largest share is occupied by India (about 55%), the countries of the European Union (about 20%) and the USA – 10%.

Let’s fulfill the forecast of world cheese exports for the period up to 2025. Let’s build a trend equation; to this end, we choose a polynomial growth curve of the third degree, since it more accurately repeats the dynamics of the original time series (Figure 10).

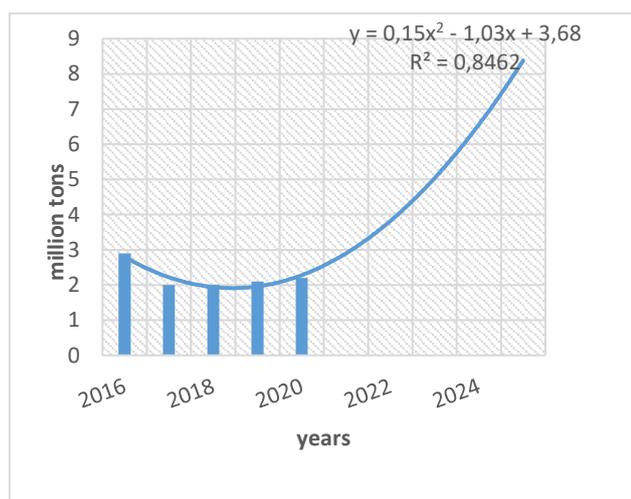


Figure 10. Forecast of world export of cheese, million tons

Source: suggested by the author

Using the equation obtained on the graph, we calculate the predicted value (Table 3).

Table 3. Forecast value of world cheese exports

Name	2021	2022	2023	2024	2025	Growth rate, 2025/2021, %
Export of cheese, million tons	2.9	3.8	5.04	6.6	8.4	289.7

Source: build by the author

Calculations showed that the growth rate of world cheese exports by 2025 will increase by 2.9 times compared to 2021, which reflects the positive dynamics of the studied indicator.

Dynamics of world production and consumption of butter is presented in Figure 11.

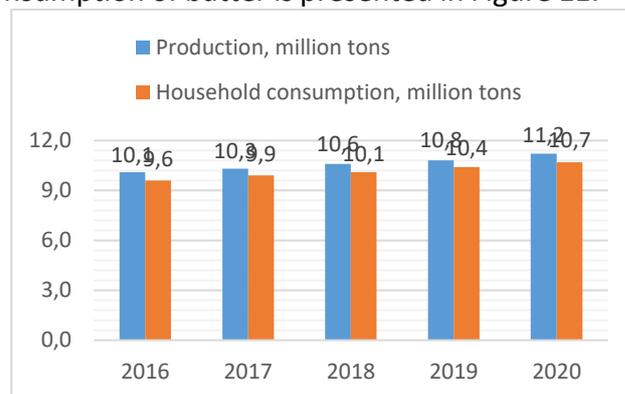


Figure 11. Dynamics of world production and consumption of butter

Source: suggested by the author

The data presented in Figure 11 shows that in 2020, the global production of butter amounted to 11.2 million tons, which increased by 10.8% compared to 2016. On average, during the study period, the volume of butter production increased annually by 2.6%.

In the overall structure of butter exports in 2020, more than half of world exports are occupied by New Zealand, followed by the countries of the European Union (27.4%) and Belarus (7.7%). India is actively increasing the export of butter (an average annual growth of about 30%). The largest importers of butter are Russia, China and the USA. Australia and Japan increase imports of butter by an average of 10% and 7% annually, respectively.

The dynamics of the world volume of exports and imports of butter is presented in Figure 12.

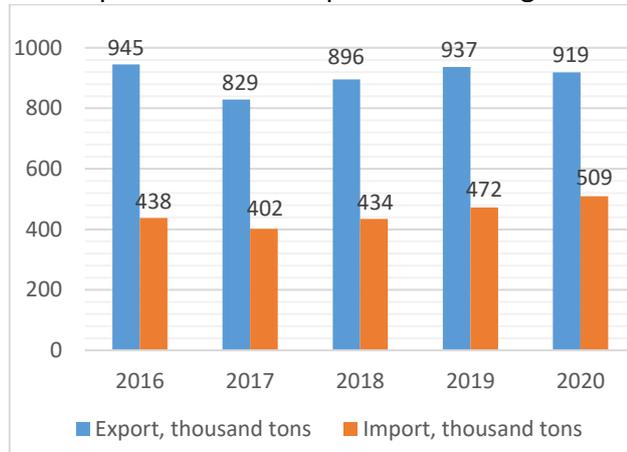


Figure 12. The dynamics of the world volume of exports and imports of butter

Source: suggested by the author

The data presented in Figure 12 shows that during the study period, world exports of butter decreased by an average of 0.7% annually. In 2020, the volume of exports amounted to 919 thousand tons, which is 1.9% less than in 2019. The global volume of imports of butter in 2020 amounted to 509 thousand tons, which is 7.8% higher than in 2019. The average annual growth rate of imports for this period amounted to 3.8%.

The largest share in the total structure of world production of skimmed milk powder is occupied by the countries of the European Union and the USA (approximately 55%). In the world production of skimmed milk powder in recent years, the share of India has increased by more than 1.5 times.

The dynamics of the world volume of production and consumption of skimmed milk powder is presented in Figure 13.

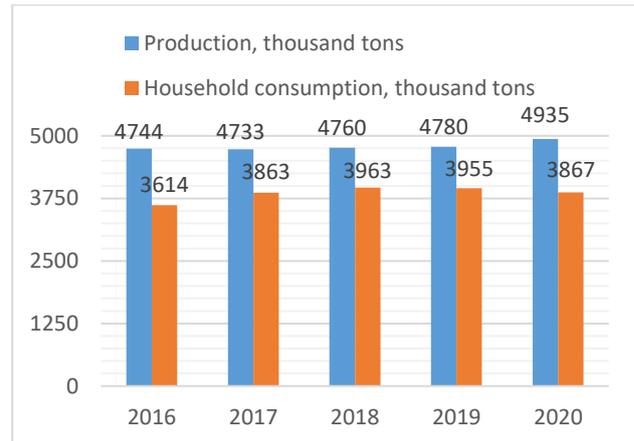


Figure 13. The dynamics of the world volume of production and consumption of skimmed milk powder

Source: suggested by the author

The data presented in Figure 13 shows that in 2020 the world production of skimmed milk powder amounted to 4935 thousand tons, which is 155 kg higher than in 2019; consumption – 3867 thousand tons, which is 88 kg lower than in 2019.

China, Mexico, Indonesia and the Philippines occupy the largest share of the import of skimmed milk powder.

The dynamics of the world volume of exports and imports of skimmed milk powder is presented in Figure 14.

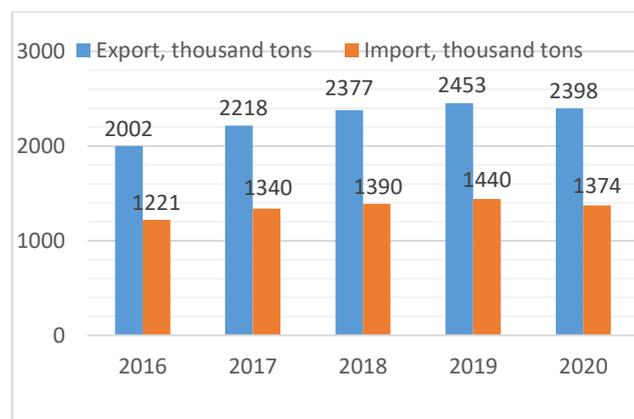


Figure 14. The dynamics of the world volume of exports and imports of skimmed milk powder

Source: suggested by the author

The data presented in Figure 14 shows that in 2020 the volume of exports amounted to 2398 thousand tons, which is lower by 396 thousand tons (or 2.3%) compared to 2019; the volume of

imports is 1374 thousand tons, which is 4.6% less. The largest share in the structure of world exports of skimmed milk powder is occupied by the countries of the European Union, the USA (approximately 60%).

New Zealand, China, Brazil, countries of the European Union, Argentina occupy the largest share in the total structure of the world production of whole milk powder.

The dynamics of the world volume of production and consumption of whole milk powder is presented in Figure 15.

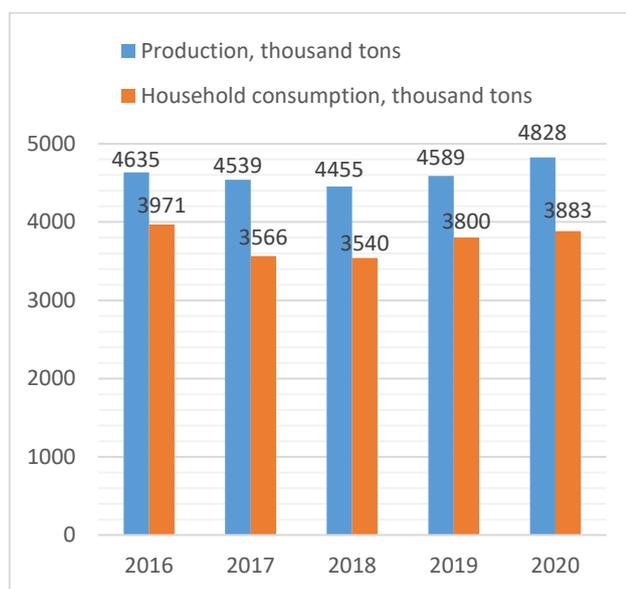


Figure 15. The dynamics of the world volume of production and consumption of whole milk powder

Source: suggested by the author

The data presented in Figure 15 shows that in 2020 the world production of whole milk powder amounted to 4828 thousand tons, which is 5.2% higher than in 2019. In 2020, the consumption of whole milk powder amounted to 3,883 thousand tons, which is 83 thousand tons more (or 2.2%) compared to 2019.

The world's largest importers of whole milk powder are China, Algeria, Brazil, Indonesia, Australia, Chile and the Philippines.

The dynamics of the world volume of exports and imports of whole milk powder is presented in Figure 16.

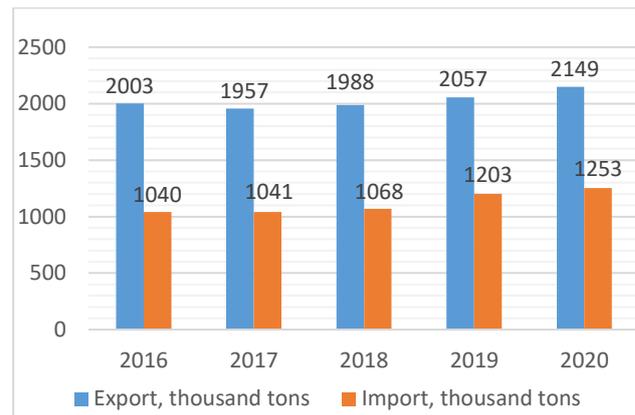


Figure 16. The dynamics of the world volume of exports and imports of whole milk powder

Source: suggested by the author

The data presented in Figure 16 shows that in 2020, world exports of whole milk powder amounted to 2,149 thousand tons, which is 92 thousand tons higher than in 2019. On average, for 2016–2020, the volume of exports of whole milk powder increased by 1.8% annually. A significant part of the world demand for dairy products is met by exports from the countries of the European Union, New Zealand, the USA, Australia and Belarus. In 2020, compared to 2019, the volume of imports of whole milk powder increased by 4.1%, and compared to 2016, by 12.5%. The average annual growth rate of whole milk powder imports for the same period was 4.8%.

World prices for dairy products are characterized by high volatility due to the dominance of a few exporting and importing countries, as well as restrictive trade policies. Figure 17 shows the Food and Agriculture Organization price index for food and dairy products for 2016–2020 (FAOSTAT, Electronic resource, 2022).

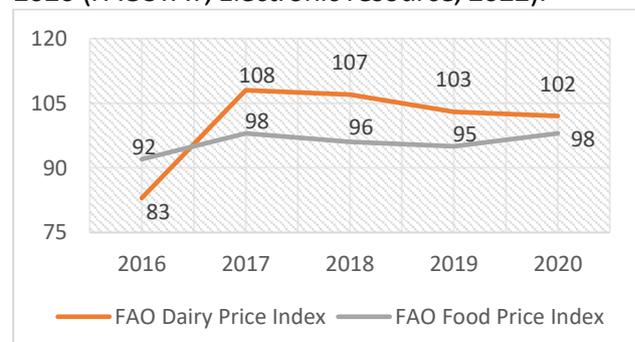


Figure 17. Food and Agriculture Organization price index for food and dairy products, 2016–2020=100

Source: suggested by the author

The data presented in Figure 17 shows that the average annual price index for dairy products in 2020 was 102%, which is 1% less compared to 2019, and 6% less compared to

2017. On average, for 2016–2020, the price index for dairy products increased by 5.4% annually.

Conclusions

According to the official statistics of the Food and Agriculture Organization of the United Nations (FAO), world milk production is increasing annually (on average for 2016–2020 by about 2.5%). In 2020, milk production amounted to 906 million tons, which is 18 million tons (2.0%) more than in 2019. The world leaders in milk production are the countries of Asia (41.8%), Europe (26.0%) and North America (12.2%), the share of which in the aggregate amounted to 80.0% in 2020. The largest volumes of milk and dairy products are produced in the countries of the European Union, USA, New Zealand, Australia, India, Brazil, Argentina. According to the forecast of the Food and Agriculture Organization for 2021–2030, world milk production will increase by 1.7% per year (up to 1.02 billion tons by 2030).

In 2020, the volume of world exports of milk and dairy products in physical terms amounted to 79 million tons in terms of milk, which is 1.3% higher than in 2019 (average annual growth rate of exports of milk and dairy products for 2016–2020 amounted to 2.6%). The main exporters of non-condensed milk and cream to the world market are Germany, France, Belgium, the Czech Republic, Austria, Great Britain and the Netherlands (they occupy more than 60% of world exports). World imports of milk and dairy products in 2020 amounted to 77.6 million tons, which is 1.5% higher than in 2019. The largest share in the total structure of world imports of

milk and dairy products is occupied by the countries of Asia (60%) and Africa (13%). At the same time, Germany and the Netherlands are both the leading exporting countries and the main importing countries of almost all types of dairy products. In general, the world trade in dairy products for 2016–2020 is characterized by positive dynamics: exports of cheese (by 15.8%), skimmed milk powder (by 19.8%) and whole milk powder (by 2.7%) increased significantly. During this period, exports of butter decreased by 5.3%.

Prospects for the development of the world market are linked to the fact that the composition of the leading producing countries will partially change, demand will grow (more than 6 billion people in the world are consumers of milk and dairy products), and the geography of exports and imports will expand. The main exporters of dairy products will be the countries of the European Union (Germany, the Netherlands, France, etc.), New Zealand and the USA (by 2030 these countries will account for approximately 65% exports of cheese and whole milk powder, 75 % butter and skimmed milk powder). It should be noted that without the development of dairy farming, there will be no development of the dairy industry. The leader will be India, which by 2030 will increase milk production by about 50%; by 2025 Africa will increase milk production by 30%.

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