Economic assessment and forecast models for the development of the agri-food sector of the Republic of Belarus

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Abstract
Dialectical method of obtaining knowledge is the general methodological basis of economics and organization, like other sciences, which considers all phenomena in development and interrelated to each other. Guided by this provision, development in the economy of the agri-food sector is studied not on an individual basis, but integrally and in conjunction with the economy and primarily with industry. The use of this method excludes a one-sided approach to the analysis of economic phenomena occurring in the agri-food sector, the maximum economic effect is ensured on the basis of the integral use of factors and conditions of agro-industry. The scientific study is based on the materials (proceedings) of foreign and domestic authors, data from the National Statistical Committee of the Republic of Belarus, the content of national programs for the development of the agro-industrial complex of the Republic of Belarus, as well as materials posted on official electronic media. The methods of systemic and comparative analysis, EMM (economic and mathematical methods) were used in the course of the study.

Keywords: agri-food sector, industry, dialectical method, one-sided approach, economic phenomena, comparative analysis.

Introduction
The global experience shows the use of various models for the effective functioning of the agri-food sector in order to ensure national food security and export potential increase. At the present stage, the economy of the Republic of Belarus adheres to a socially oriented model of economic development, in which the provision of the population with food and the improvement of the population quality of life and innovation are the fundamental factors (https://www.belstat.gov.by, 2021; Reading G.O, 2018; Efimenko A.G., 2017).

The agro-industrial sector is an important structural element in the system of ensuring national food security in the context of innovative development of the economy (Mickiewicz B., 2018; Economic Bulletin, 2015; https://www.pravo.by, 2021).

The relevance of ensuring food security necessitates a study on economic assessment and the development of forecast models for sustainable innovative development of the agri-food sector.

Material and methods
The Republic of Belarus is located in the centre of Europe and belongs to the Eastern European states, its territory is 207.6 thousand square kilometres. Agricultural industry is

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developing, it has a high level of specialization in milk and meat cattle breeding with developed production of grain and rapeseed.

There are over 1,380 different organizations engaged in the agricultural production in the agro-industrial complex. The largest share in the overall structure of agricultural organizations by organizational legal forms in 2020 is occupied by joint stock companies (CJSC) – 45.8%, which is 10.9% less compared to 2017 and unitary enterprises (UE) – 32.4%, which is 14.5% less than in 2017. During the studied period, there was an increase in the number of limited liability companies (LLC) by 22.7%.

In the Republic of Belarus, the total area of agricultural land as of 01.01.2021 amounted to 8,283.9 thousand hectares, which is 217.7 thousand hectares less than in 2018. The largest share in the overall structure of agricultural land is occupied by the land of agricultural organizations – 88.1% in 2021, which is 0.7% less than in 2018.

In the model of agricultural production by categories of farms, the largest share was occupied by agricultural organizations – 80.9% in 2020, which is 1.8% higher than in 2016, household farms – 3.6% lower. During the studied period, there was an increase in the share of peasant (farmer) households by 0.9%.

Agriculture of Belarus specializes in the cultivation of crops traditional for middle latitudes. Crop and livestock production are the leading branches of agricultural industry. Grain crops predominate in crop production: mainly barley, rye, wheat, potatoes, fodder crops. The sown area of grain legumes and oil plants is expanding in the republic in connection with structural transformations and an orientation towards renewable energy sources. Grain crops are cultivated in all regions of the country and their share in the structure of farm land is 40-45%. The need of the republic for grain is 9-10 million tons (taking into account the restoration of export potential). The overall yield of grain and grain legume crops increased by 5.4%, rye – by 11.4%, wheat – by 7.9% and barley – by 6.7% in 2020, compared to 2017.

Providing the population with food is a basic element of the country’s economic and social security. Analysis of the dynamics of agricultural production per capita showed that agricultural production per capita increased by 50.1% in 2020 compared to 2016. Grain production per capita increased during the studied period by 19.1%, milk – by 4.5%, and livestock and poultry – by 11.4% (carcass weight equivalent) (www.belstat.gov.by, 2021).

Forecasting economic development trends is closely related to economic and mathematical modelling of the functioning of the social and economic system. The dynamic processes taking place in the economy are manifested in the form of a series of chronologically arranged values of a certain indicator, which reflects the development of the economic phenomenon under study in real time. The values of the indicators are the basis for the development of trend models. A trend is a stable systematic change in a process over a long period of time. The construction of a trend model helps identify trends in the dynamics of a specific indicator and predict the development of the process under study for a strategic perspective. The construction of trend models is carried out on the basis of growth curves that express the qualitative properties of development: polynomial, exponential, logarithmic, power. Polynomial growth curves are used to approximate and predict economic processes in which subsequent development does not depend on the achieved level (http://www.gknt.gov.by, 2021).

**Results and discussion**

Let us carry out a forecast of agricultural production per capita for the period from 2021 to 2025. Let us construct a trend equation; in order to do that, we choose a polynomial growth curve of the third degree, since it more accurately reflects the dynamics of the original time series (R-squared value = 0.9907) (Fig. 1).
Let us calculate the predicted value using the equation obtained on the diagram (Table 1).

Table 1 – Forecast of agricultural production per capita

<table>
<thead>
<tr>
<th>Name</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>Growth rate, 2025/2021, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural production per capita, RUB</td>
<td>2,705.86</td>
<td>3,017.13</td>
<td>3,383.08</td>
<td>3,820.83</td>
<td>4,313.11</td>
<td>159.4</td>
</tr>
</tbody>
</table>

Calculations showed that the growth rate of agricultural production per capita by 2025 will be 59.4% compared to 2021, which reflects the positive dynamics of the indicator under study.

The dynamics of the main indicators of agricultural organizations operating efficiency is given in the Table 2.

Table 2 – Dynamics of the main indicators of agricultural organizations operating efficiency

<table>
<thead>
<tr>
<th>Indicators</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>Growth rate, 2019 / 2016, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue from product sales, million RUB</td>
<td>9,723.9</td>
<td>11,038.7</td>
<td>11,747.8</td>
<td>12,919</td>
<td>132.9</td>
</tr>
<tr>
<td>Cost of products sold, million RUB</td>
<td>8,533.1</td>
<td>9,231.5</td>
<td>10,145.4</td>
<td>11,139</td>
<td>130.5</td>
</tr>
<tr>
<td>Profit from product sales, million RUB</td>
<td>215.9</td>
<td>707.8</td>
<td>434.5</td>
<td>500.6</td>
<td>231.8</td>
</tr>
<tr>
<td>Profit before tax, million RUB</td>
<td>227.2</td>
<td>705.5</td>
<td>501.1</td>
<td>887.5</td>
<td>390.6</td>
</tr>
<tr>
<td>Net profit, million RUB</td>
<td>219.8</td>
<td>698.2</td>
<td>496.9</td>
<td>881.2</td>
<td>400.9</td>
</tr>
<tr>
<td>Product profitability, %</td>
<td>2.5</td>
<td>7.7</td>
<td>4.3</td>
<td>4.5</td>
<td>+2.0 p.p.</td>
</tr>
<tr>
<td>Return on sales, %</td>
<td>2.2</td>
<td>6.4</td>
<td>3.7</td>
<td>3.9</td>
<td>+1.7 p.p.</td>
</tr>
</tbody>
</table>

The performed analysis of the data given in the Table 2 showed that there is an increase in the agricultural organizations operating efficiency during the studied period: revenue
from product sales increased by 32.9%, profit from product sales — by 131.8%, profit before tax — 3 times, net profit — 4 times. The profitability of sold products increased by 2 percentage points and return on sales increased by 1.7 percentage points.

At this stage, the processing industry of the Republic of Belarus is an integral part of the agro-industrial complex, which is closely related to trade and agriculture as a raw material base. The strategic goal of the development of the processing industry is to provide the population with various foodstuffs sufficient for a balanced diet, healthy nutrition, and to ensure the country’s food security.

The main global trends typical for the food industry include the following: personalization of nutrition and creation of new products of various functional orientation, expansion of the production of products for children (with a high content of milk, probiotics, vitamins, etc.); increased attention of consumers and manufacturers to the proportion of ingredients in products; transition to sustainable production criteria, which include traceability of raw materials and manufacturing process, the use of certified palm oil and other ingredients, environmentally safe product packaging and transparency of information for consumers; transformation of food sales channels under the influence of digital technologies; sustainable preservation of the dominant position of world leaders in the field of foodstuffs production; strengthening the role of corporate and product brand names in the formation of added value of products and the innovative orientation of companies’ development as a key factor in competition in the world food markets. Analysis of global trends showed that the main competitors of the Republic of Belarus in the food market are increasing their export potential and competitive advantages (Pilipuk A.V., Kondratenko S.A., 2019).

The performed analysis showed that the volume of food production increased in 2016-2019 (the growth rate was 31.7% in 2019 compared to 2016) along with a decrease by 102 units in the number of organizations of the processing industry. The average number of employees decreased in 2019 by 3.5 thousand people compared to 2016, the growth rate of the average monthly wage was 39.2%. The growth rate of profit from product sales amounted in 2019 to 97.2% compared to 2016. The return on sales decreased by 2.1 percentage points during the studied period (Saiganov A.S., Panteleeva I.I., 2019).

In 2020, the largest share in the structure of volume of food production is occupied by the production of dairy products — 29.2%, meat and meat products — 23.3%, ready-made animal feeds — 11.9%, beverages — 7.4%. The production of food products increased during the studied period: meat and meat by-products — by 15.9%, meat and meat-containing semi-finished products – by 53.2%, fish and seafood – by 39.1%, vegetable oil – 3 times, cheese – by 41.4%, ready-made products for child nutrition – by 34.9%, butter and dairy spread – by 1.3%. At the same time, the production of sausage products decreased – by 0.7%, flour – by 32.7%, macaroni products – by 12.1% during the studied period.

In 2021, the largest share in the overall structure of consumer spending of the population of the Republic of Belarus is occupied by foodstuffs and non-alcoholic beverages (34.8%). In the Republic of Belarus, the growth rate of consumption of food products per capita increased in 2019 compared to 2016: meat and meat products — by 5.4%, fish and fish products — by 2.4%, sugar — by 3.7%, vegetables, melons and gourds — by 4.1%, fruits and berries — by 7.8%, potatoes — by 2.3%. There was a decrease in the consumption of milk and dairy products — by 0.4%, vegetable oil — by 1.6%, and bread products — by 7.3% during the studied period.

The development of the processing industry makes it possible to meet the public demand for food, to increase their export potential in a competitive environment. In 2019, the share of the Republic of Belarus in the structure of world trade for certain types of products was: animal oil — 4.2% (7th place), skimmed milk powder —
3.2% (10th place), rapeseed oil – 3.0% (8th place), cheese and cottage cheese – 3.0% (10th place), sausage products – 1.6% (16th place).

The Republic of Belarus exported agricultural goods and food supplies to foreign markets in the amount of USD 5,536.8 million in 2019 (an increase of 11.4% against the level of 2017).

The dynamics of the volume of foreign trade in agricultural products and foodstuffs is given in the Table 3.

Table 3 – Dynamics of the volume of foreign trade in agricultural products and foodstuffs, USD million

<table>
<thead>
<tr>
<th>Name</th>
<th>Years</th>
<th>Growth rate, %, 2019 / 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign trade in agricultural products and foodstuffs</td>
<td>2017 9,555.0 2018 9,704.5 2019 10,192.6</td>
<td>106.7</td>
</tr>
<tr>
<td>- export</td>
<td>2017 4,971.2 2018 5,280.1 2019 5,536.8</td>
<td>111.4</td>
</tr>
<tr>
<td>- import</td>
<td>2017 4,583.8 2018 4,424.4 2019 4,655.8</td>
<td>101.6</td>
</tr>
<tr>
<td>- balance</td>
<td>2017 387.4 2018 855.7 2019 881.0</td>
<td>227.4</td>
</tr>
</tbody>
</table>

Source: build by the author

The data in the Table 3 shows that the growth rate of the volume of foreign trade in agricultural products and food products in 2019 amounted to 6.7% compared to 2017.

Let us carry out the forecast for the export of agricultural products and food products for 2021-2025. Let us construct a trend equation; in order to do that, we choose a polynomial growth curve of the second degree, since it more accurately reflects the dynamics of the original time series (R-squared value = 0.8323) (Figure 2).

![Figure 2 – Forecast of production of export agricultural products and foodstuffs](source: suggested by the author)

Let us calculate the forecast for the export of agricultural products and foodstuffs using the equation obtained on the diagram (Table 4).

Table 4 – Forecast for the export of agricultural products and foodstuffs

<table>
<thead>
<tr>
<th>Name</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>Growth rate, 2025 / 2021, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Export of agricultural products and foodstuffs</td>
<td>6,671.8</td>
<td>7,624.3</td>
<td>8,763.4</td>
<td>10,089</td>
<td>11,601.2</td>
<td>173.9</td>
</tr>
</tbody>
</table>

Source: build by the author
Calculations showed that the growth rate of exports of agricultural products and food products by 2025 will be 73.9% compared to 2021.

The state regulation of export promotion, the creation of a favourable investment climate for investors, commodity producers and exporters are one of a number of the factors to increase the efficiency of the functioning of the agri-food sector.

At this stage, the transition to science-based innovative production of products with high added value is relevant and in demand in the agri-food sector.

The dynamics of the volume of shipped innovative products by industrial organizations of the Republic of Belarus is given in the Table 5.

Table 5 – Dynamics of the volume of shipped innovative products by industrial organizations of the Republic of Belarus

<table>
<thead>
<tr>
<th>Name</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>Growth rate, % 2019/2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry</td>
<td>13,040,740</td>
<td>16,170,970</td>
<td>15,288,732</td>
<td>117.2</td>
</tr>
<tr>
<td>of it: manufacturing industry</td>
<td>12,997,794</td>
<td>16,114,363</td>
<td>15,287,699</td>
<td>117.6</td>
</tr>
<tr>
<td>including the production of foodstuffs, beverages and tobacco</td>
<td>564,307</td>
<td>551,220</td>
<td>701,148</td>
<td>124.2</td>
</tr>
</tbody>
</table>

The data in the Table 5 shows that the growth rate of the volume of shipped innovative products in the industry as a whole was 17.2%, including in the processing industry – 24.2% during the studied period.

Let us carry out the forecast of shipped innovative products for 2021-2025. Let us construct a trend equation; in order to do that, we choose a polynomial growth curve of the third degree, since it more accurately reflects the dynamics of the original time series (R-squared value = 0.9447) (Figure 3).

Let us calculate the forecast for the share of shipped innovative products (foodstuffs, beverages and tobacco products) using the equation obtained in the diagram (Table 6).

Table 6 – Forecast for the share of shipped innovative products (foodstuffs, beverages and tobacco products)

<table>
<thead>
<tr>
<th>Name</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>Growth rate, 2025 / 2021, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of shipped innovative products, %</td>
<td>1.45</td>
<td>1.46</td>
<td>1.72</td>
<td>2.26</td>
<td>3.1</td>
<td>+1.65</td>
</tr>
</tbody>
</table>

Calculations showed that the share of shipped innovative products will increase to 3.1% by 2025. The growth rate of this indicator will be 1.65% compared to 2021.
Conclusions

Based on the results of the assessment, it was established that a further increase in the volume of production and sales of products, exports of agricultural products and foodstuffs, and an increase in investment attractiveness are possible subject to the activation of the competitive advantages of organizations in the agri-food sector in the context of international economic integration. The processing industry of the Republic of Belarus belongs to the dynamically developing sectors of the economy. This is due to demand factors, including population growth and growth in income, consumer orientation towards high-quality, healthy, functional and specialized nutrition on the one hand, and by the potential of commodity producers on the other hand, which is characterized by the ability to transform under the influence of consumer preferences, the degree of concentration of investment resources, innovative activity and the formation of competitive strategies. In general, the identified trends indicate a production and economic potential of the processing industry of the Republic of Belarus, which is sufficient to ensure sustainable innovative development and expanded reproduction of food supplies.

References


