Formation features and economic forecast of the production potential growth of the agro-food organizations

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Abstract

The article considers the main approaches to the composition, structural elements, features and assessment of the production potential of organizations in the agro-food sector. The application of an integrated approach to assessing the production potential of organizations in the agro-food sector according to the scheme: resources-maximum opportunities-result-evaluation-forecast has been substantiated. Based on these positions, fixed and working capital, labor resources can be combined into the concept of "production potential of organizations in the agro-food sector". If there are sufficient resources, their rational structure, the organization of the agro-food sector has the necessary conditions for production and commercial activities, the achievement of planned goals and development parameters, and the generation of economic benefits. The assessment of the level of the production potential of the agro-food sector is based on the use of the following approaches: dialectical, which allows us to consider the production potential as a complex, multilateral, contradictory phenomenon, taking into account its development and constant movement; systemic, which allows to explore the production potential as an integral complex of interrelated elements, to establish the method, nature of the relationship between them, as well as the internal relationship of categories; synergistic, considering the production potential as a self-developing system, which makes it possible to justify its growth as a result of combining individual elements into a single system, that is, by obtaining a systemic effect.

Keywords: production potential, agro-food sector, working capital, labor resources, dialectical approach, systemic approach, synergistic approach.

Introduction

In economic theory, a production function is used to describe the production process, which connects the available resources, production technology with the maximum possibilities for the production of goods and services.

The magnitude of the production potential of the agri-food sector is important for internal (management, personnel) and external (shareholders, investors, banks) stakeholders, as it allows characterizing the possibilities, the maximum ability of organizations to implement tactical and strategic goals. As the main factors of production, labor and capital are considered, which are interconnected by a certain technology. Solving the problems of sustainable economic development and further growth of the agro-food sector of the Republic of Belarus requires the development of ways to improve the efficiency of using its production potential. In this regard, a comprehensive economic analysis of the production potential of organizations in the agro-food sector as an integral part of the total capital is needed, which makes it possible to make comparable estimates.
of fixed and working capital, labor in relation to specific production conditions. Elements of the production potential of organizations in the agro-food sector can be considered resources that are associated with the functioning and their development. The choice of the most important of their number is a complex, current and scientific problem, as evidenced by the many opinions in the economic literature on the composition, structural elements and assessment of productive potential.

The production potential on the scale of the national economy is defined as the totality of all resources and conditions of social production, it is estimated by the volume of production of goods and services (GDP), the production capacities of industrial enterprises and construction organizations, the possibilities of agricultural production, and the level of development of the production infrastructure (Shimov, V.N., 2009).

The concept of "production potential" includes a set of resources that in the production process take the form of factors of production. The production potential is characterized by the optimal use of all the production resources of the organization in the conditions of scientific and technological progress (Azrilian, A.N., 2002). The production potential is considered as a complex of interconnected enterprises located on the territory of the region, industries that have material and technical means and labor force (resources), capable of producing a strictly defined volume of products and providing services under the prevailing objective conditions (Borodin, A.I., 2012).

It should be noted that along with the use of the concept of "production potential" by many economists, research is carried out without a close relationship with its participation in the process of production of goods (products, works, services). There are two main concepts in substantiating the essence of the production potential of organizations - resource and performance. Within the framework of the resource approach, production potential is defined as a set of resources that are interconnected and interact and capable of producing wealth. With an effective approach, the essence of the production potential of organizations is defined as potential opportunities (production output, profit, indicators of the efficiency of resource use, working time, etc.) (Efimenko, A.G., Mitskevich, B., Efimenko, A.G., Volkova, E.V., 2020).

The optimal use of available material, labor and other types of resources contributes to improving the efficiency of the functioning of organizations in the agro-food sector in the conditions of innovative development of the economy (Mickiewicz, B., Efimenko, A., Volkova, E., 2021).

A methodological tool for assessing the functioning of organizations in the agro-food sector are econometric models that reflect the relationship between performance indicators and the factors that determine them and allow us to solve the following tasks: an objective assessment of the activities of organizations in the agro-food sector; calculation of optimal volumes of resources with the establishment of their rational ratio, identification of reserves for increasing the efficiency of organizations based on the assessment of the payback of resources (Shafranskaya, I.V., 2010, Drogobytsky, I.N., 2004).

**Material and methods**

To solve these problems, production function is used. The relationship between the number of factors of production used and the maximum possible output is called the production function. Technically efficient are production options that cannot be improved either by increasing the production of a product without increasing the consumption of resources, or by reducing the costs of any resource without reducing output and without increasing the costs of other resources. The production function takes into account technically efficient options (this is the maximum amount of product that an organization can produce for given volumes of resource consumption).
Results and discussion

The analysis showed that in the Republic of Belarus the largest share in the structure of industrial production by type of economic activity "production of food products, including drinks, and tobacco" in 2020 is occupied by Minsk (22.6%), Brest (22.8%) and the Grodno region (19.8%), which is due to the location of large organizations of the processing and food industries in them. The share of the Mogilev region in the structure of industrial production by type of economic activity "production of food products, including drinks, and tobacco" in 2020 amounted to 8% (Official site of the National Statistical Committee of the Republic of Belarus, 2021).

The processing industry of the Mogilev region is one of the most dynamically developing industries. The structure of the volume of industrial production by types of economic activity in the Mogilev region is given in table 1.

The data given in table 1 show that in 2020 the manufacturing industry occupies the largest share in the structure of industrial production in the Mogilev region - 89.5%, which is 2.6% higher compared to 2016. In 2020, the share of the food industry in the total volume compared to the manufacturing industry of the Mogilev region amounted to 25.5%, which is 3.4% higher than in 2016.

Table 1 - The structure of the industrial production volume of the Mogilev region, %

| Industry                        | 2016 | 2017 | 2018 | 2019 | 2020 | +/-, % |
|---------------------------------|------|------|------|------|------|--------|
| Industry - total:               | 100  | 100  | 100  | 100  | 100  | -      |
| including manufacturing industry| 86,9 | 89,1 | 89,4 | 89,9 | 89,5 | +2,6   |
| including food production       | 28,9 | 27,6 | 24,4 | 23,8 | 25,5 | +3,4   |

Source: build by the author

The dynamics of food production in the Mogilev region is given in table 2.

Table 2 - Dynamics of food production in the Mogilev region, thousand tons

| Food production                                           | 2016  | 2017  | 2018  | 2019  | 2020  | Growth rate, % |
|-----------------------------------------------------------|-------|-------|-------|-------|-------|----------------|
| Meat and edible products by-products                      | 123,4 | 123,0 | 132,7 | 140,0 | 141,9 | 114,9          |
| Sausages                                                  | 22,0  | 20,5  | 23,4  | 22,8  | 22,5  | 102,3          |
| Whole milk products (in recalculation on milk)            | 283,0 | 280,3 | 320,3 | 359,9 | 391,3 | 138,3          |
| Milk and cream powder                                     | 24,9  | 28,3  | 22,8  | 15,6  | 14,7  | 59,0           |
| Butter                                                    | 17,0  | 17,9  | 12,7  | 11,8  | 11,8  | 69,4           |
| Cheese (except processed cheese)                          | 11,9  | 11,3  | 7,2   | 13,7  | 18,2  | 152,9          |
| Flour from cereals, vegetables and other vegetable crops  | 120,9 | 104,8 | 71,5  | 45,1  | 41,7  | 34,5           |
| Groats                                                    | 19,8  | 20,4  | 13,8  | 8,9   | 10,0  | 50,5           |
| Bread, bakery and flour confectionery products not intended for long-term storage | 58,1  | 55,2  | 50,3  | 45,4  | 42,3  | 72,8           |
| Chocolate, chocolate and sugar confectionery               | 15,4  | 16,4  | 16,9  | 19,5  | 18,6  | 120,8          |
| Canned fruits and vegetables                              | 34,9  | 38,4  | 46,4  | 50,8  | 45,6  | 130,6          |
| Juices for baby food                                      | 1795  | 2111  | 2201  | 1902  | 1620  | 90,2           |

Source: build by the author
Table data shows that for 2016-2020 in the Mogilev region, the production of food products increased: meat and food offal - by 14.9%, whole milk products - by 38.3%, sausages - by 2.3%, cheese - by 52.9%, canned fruits and vegetables - by 30.6%. During the study period, the production of milk and dried cream decreased by 37.4%, cereals - by 55%, bread, bakery and flour confectionery products not intended for long-term storage - by 21.9%, flour from cereals, vegetables and other vegetable crops - by 62.7%, juice for baby food - by 93.8%.

The most famous neoclassical production function is the Cobb-Douglas model, which expresses the dependence of the volume of production $Q$ on capital costs (material resources) $K$ and labor costs (intangible resources) $L$:

$$Q = AK^\alpha L^\beta,$$

(1)

where $A$, $\alpha$, $\beta$ – numerical parameters.

Average productivity (capital return and labor productivity) are determined by the formulas:

$$AQ_K = AK^{\alpha-1}L^\beta, AQ_L = AK^\alpha L^{\beta-1},$$

(2)

The marginal productivity of capital and labor are:

$$MQ_K = \alpha AK^{\alpha-1}L^\beta = \alpha AQ_K,$$
$$MQ_L = \beta AK^\alpha L^{\beta-1} = \beta AQ_L,$$

(3)

Partial elasticities are calculated as follows:

Thus, the parameters $\alpha$ and $\beta$ are equal to the partial elasticities of the model and determine the returns to the scale of production.

As the main elements of the production function of organizations in the agro-food sector, capital (fixed and circulating) and labor were used.

The production function for the formation of revenue from the sale of products has the following form:

$$y_s = a_0 x_1^{a_1} x_2^{a_2} x_3^{a_3},$$

(5)

where $y_s$ – proceeds from the sale of products, thousand rubles.;

$a_0$ – coefficient that helps to compare the performance of the model in dynamics;

$a_1, a_2, a_3$ – regression coefficients reflecting the degree of influence of the factor indicator on the effective one (respectively, fixed and working capital, labor costs);

$x_1$ – cost of fixed capital, thousand rubles;

$x_2$ – the cost of working capital, thousand rubles;

$x_3$ – average number of employees, pers.

At the first stage of the analysis, a system of estimated economic indicators of the activities of organizations in the agro-food sector of the Mogilev region is selected and a matrix of initial data is built (table 3).

| Indicators                          | Enterprise |
|------------------------------------|------------|
|                                    | 1         | 2       | 3    | 4    | 5    | 6    | 7    | 8    |
| Capital productivity, rub./rub.    | 4,96      | 3,43    | 3,03 | 0,82 | 0,46 | 2,25 | 0,60 | 2,83 |
| Working capital turnover ratio, rub./rub. | 7,49    | 3,14    | 1,41 | 2,79 | 0,62 | 2,68 | 0,38 | 2,50 |
| Labor productivity, thousand rubles/person | 311,21  | 232,86  | 221,08 | 96,41 | 66,09 | 117,92 | 46,96 | 42,61 |
| Material return, rub./rub.         | 1,09      | 1,05    | 1,17 | 1,21 | 1,17 | 1,20 | 1,08 | 1,04 |
To clarify the features of the formation of revenue from the sale of products and assess the change in production factors, the approbation of the production function was carried out according to the reports of organizations of the agro-food sector of the Mogilev region.

At the same time, the cost of total capital was determined as the sum of fixed and working capital, multiplied by an adjustment coefficient, which is calculated using the following formula:

$$K_i = \frac{a_2}{a_1}, \quad (6)$$

where $a_1$ and $a_2$ – regression coefficients of linear one-factor models (formulas 7-9):

$$y_x(2018) = -2693,7 + 2,145x_1, \quad (7)$$

$$y_x(2019) = -16824,972 + 2,016x_1, \quad (8)$$

$$y_x(2020) = -34073,090 + 2,561x_1, \quad (9)$$

where $y_x$ – proceeds from the sale of products, thousand rubles;

$x_1$ – cost of fixed capital, thousand rubles;

$x_2$ – cost of working capital, thousand rubles.

The production function describing the formation of revenue from the sale of products of organizations in the agro-food sector from the factors taken into account has the form:

$$y_x(2018) = -25910,916 + 1,096x_1 - 0,323x_2 + 91,481x_3, \quad (10)$$

$$n = 27, R = 0,847, D = 71,78, F = 19,5, \quad t_{a0}=-1,024, t_{a1} = 2,165, t_{a2} = -1,956, t_{a3} = 3,728.$$  

$$y_x(2019) = 23822,7 - 0,161x_1 + 0,567x_2 + 31,933x_3, \quad (11)$$

$$n = 27, R = 0,942, D = 88,83, F = 60,94, \quad t_{a0}=-1,149, t_{a1} = 2,409, t_{a2} = 5,301, t_{a3} = 3,433.$$ 

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| Share of exports in the overall structure of product sales, % | 50,54 | 34,50 | 31,37 | 9,21 | 3,50 | 21,66 | 3,28 | 7,90 |
|---------------------------------------------------------------|--------|--------|--------|------|------|--------|------|------|
| Product sales profitability, %                                | 5,34   | 0,75   | 6,78   | 9,16 | 5,53 | 5,99   | 0,27 | 3,71 |
| Profitability production, %                                   | 1,32   | 0,21   | 0,69   | -11,19 | -6,27 | 1,11   | 2,11 | 0,33 |
| Revenue from product sales, thousand rubles                   | 154673 | 16766  | 613057 | 71630 | 26038 | 124881 | 64057 | 68818 |
| Average annual cost of working capital, thousand rubles       | 20649,5 | 5345   | 434014,5 | 25696 | 41845,5 | 46609 | 168799,5 | 27487 |
| Average annual cost of fixed assets, thousand rubles          | 31162,5 | 4894   | 202343  | 87293,5 | 56915 | 55428,5 | 107602,5 | 24303,5 |
| Production cost, thousand rubles                              | 141375 | 15914  | 526160  | 59323 | 22312 | 104385 | 59259 | 66354 |
| Average number of employees, pers.                            | 497    | 72     | 2773    | 743   | 394   | 1059   | 1364  | 1615 |
| Profit from the sale of products, thousand rubles.            | 7551   | 120    | 35690   | 5436  | 1233  | 6255   | 159   | 2464 |
| Net profit, thousand rubles                                   | 1862   | 33     | 3634    | -6640 | -1400 | 1159   | 1248  | 220  |

Source: build by the author
$y_x (2020) = -42606 + 2051x_1 - 0.897x_2 + 99,915x_3$, \hspace{1cm} (12)

$n = 27, R = 0.886, D = 78.46, F = 27.93,
\quad t_a0 = -1.526, t_a1 = 3.320, t_a2 = -2.083, t_a3 = 2.589.$

where $y_x$ – proceeds from the sale of products, thousand rubles;

$n_x$ – number of observations;

$R$ – multiple correlation coefficient;

$D$ – coefficient of determination;

$F$ – Fisher’s criterion;

$t_i$ – Student statistics;

$t_{a0}$ – free coefficient;

$t_{a1}$ – the significance of the regression coefficient of the cost of fixed capital;

$t_{a2}$ – the significance of the regression coefficient of the cost of working capital;

$t_{a3}$ – the significance of the regression coefficient of labor costs.

Stable characteristics of production functions indicate an adequate description of the simulated process. Multiple correlation coefficients (their value is equal to 0.847; 0.942 and 0.886) reflect the close relationship between performance and factor indicators.

The coefficients of determination indicate that the factors taken into account in the model explain the variation in the effective indicator in 2018 - by 81.78%, in 2019 - by 88.83%, in 2020 - by 78.46%.

According to the calculated value of the Fisher coefficient, which exceeds its tabular value, it is possible to evaluate the significance of the obtained production functions.

Using the obtained production function, it is possible to calculate the marginal and average productivity of labor and capital in order to assess the efficiency of the use of production factors (this is the calculation of the average, marginal and average partial product). The average productivity (average product) of the i-th resource shows the volume of production per unit cost of the corresponding resource and is calculated by the formula:

$$AP_i = \frac{f(x)}{x_i}, i = 1, 2, ..., m,$$ \hspace{1cm} (13)

The marginal productivity (marginal product) of the i-th resource shows what additional output falls on each additional unit of costs of the corresponding resource, provided that the costs of other resources do not change, that is, it reflects the contribution of the resource to the increase in production and is calculated by the formula:

$$MP_i = \frac{df(x)}{dx_i}, i = 1, 2, ..., m.$$ \hspace{1cm} (14)

To substantiate the directions for the development of production potential, the methodology was tested in organizations of the agro-food sector of the Mogilev region.

The production functions that describe the formation of proceeds from the sale of products from the average number of employees (x1, people) and the cost of total capital (x2, thousand rubles) are the following:

$y_x (2018) = 988,2123x_1^{0.018}x_2^{0.636}$, \hspace{1cm} (15)

$n = 27, R = 0.823, D = 67.79, F = 25.25,$

$t_a0 = 1.19, t_a1 = 2.153, t_a2 = 4.345.$

$y_x (2019) = 271.3x_1^{0.222}x_2^{0.502}$, \hspace{1cm} (16)

$n = 27, R = 0.936, D = 87.69, F = 85.48,$

$t_a0 = 0.42, t_a1 = 6.885, t_a2 = 1.963.$

$y_x (2020) = 55,774x_1^{0.673}x_2^{0.8395}$, \hspace{1cm} (17)

$n = 27, R = 0.8282, D = 68.60, F = 26.21,$

$t_a0 = -1.654, t_a1 = 2.747, t_a2 = 3.925.$

The values of the characteristics of production functions indicate the possibility of using it to quantify the potential. The significance of individual factors in the formation of the final result of the use of the resource element of the economic potential can be determined using the elasticity coefficient.

Calculations show that the greatest impact on the increase in revenue from the sale of products of organizations in the agro-food sector is exerted by labor costs. An increase in labor costs by 1% leads to an increase in revenue from product sales in 2018 - by 0.636%, in 2019
- by 0.502%, in 2020 - by 0.8395%. An increase in the total capital of enterprises by 1% leads to an increase in the effective indicator in 2018 - by 0.018%, in 2019 - by 0.222%, in 2020 - by 0.6573%.

The calculation of the marginal and average resource products of the organizations of the agro-food sector of the Mogilev region is given in table 4.

### Table 4. Dynamics of marginal and average resource products of organizations of the agro-food sector of the Mogilev region

| Indicators | 2018 | 2019 | 2020 | Growth rate, 2020 / 2018, % |
|------------|------|------|------|----------------------------|
| Capital, rub./rub. | 1,563 | 1,713 | 2,568 | 164.3 |
| Average product | 0.028 | 0.38 | 0.799 | +0.771 |
| Marginal product | 0.018 | 0.222 | 0.653 | +0.6393 |
| Release elasticity | 94.96 | 98.15 | 186.21 | 196.1 |
| Product, thousand rubles/person | 60.36 | 49.24 | 82.30 | 136.3 |
| Average product | 0.636 | 0.502 | 0.840 | +0.2 |
| Marginal product | 0.654 | 0.724 | 1.497 | +0.8 |

**Source**: build by the author

Table 4 illustrates that the maximum level of the average and marginal product in terms of capital and labor was achieved in 2020 in the organizations of the agro-food sector of the Mogilev region. During the study period, there was an increase in the average product for capital in 2020 compared to 2018 - by 64.3%, for marginal product - by 0.771 units. Analyzing the average and marginal labor productivity for 2018-2020, it should be noted the growth of the average product - by 96.1% and marginal product - by 36.3%.

The highest elasticity of production was achieved in 2020, which indicates that with an increase in resources by 1%, revenue from product sales will increase by 1.497%.

Using production functions (as one of the ways to describe the technology), the optimal ratio of resources is determined, at which the largest volume of production is achieved in the organizations of the agro-food sector of the Mogilev region. The isquant combines the ratio of resources (labor and capital costs) that provide the optimal volume of output. An isocline, in the theory of production functions, is a geometric locus of points (in the space of resources) at which the marginal rates of substitution of production factors (resources) for different isoquants are the same (Voroboy, V.A., Filiptsov, A.M., Cheplyansky, Yu.V., 2003).

Figure 1 shows the optimal ratio of resources of organizations of the agro-food sector of the Mogilev region.

**Figure 1.** Optimal ratio of resources of organizations agro-food sector of the Mogilev region

**Source**: suggested by the author

The proposed assessment makes it possible to model the directions for increasing the efficiency of the activities of organizations in the agro-food sector of the Mogilev region, depending on the optimal ratio of the structure of resources (labor and capital costs).

The forecast for increasing the efficiency of the activities of organizations in the agro-food sector is given in table 5.
Table 5. Forecast of increasing the efficiency of organizations in the agro-food sector

| Enterprise | Revenue from product sales, 2020, thousand roubles | Forecast, thousand roubles | Growth rate, % forecast/actual data |
|------------|---------------------------------------------------|---------------------------|-----------------------------------|
| 1          | 154673                                            | 155153,6                  | 100,3                             |
| 2          | 16766                                             | 17022,4                   | 101,5                             |
| 3          | 613057                                            | 622903,8                  | 101,6                             |
| 4          | 71630                                             | 73927,7                   | 103,2                             |
| 5          | 26038                                             | 32906,0                   | 126,4                             |
| 6          | 124881                                            | 151668,0                  | 121,5                             |
| 7          | 64057                                             | 69500,8                   | 108,5                             |
| 8          | 68818                                             | 83144,7                   | 120,8                             |
| Total      | 1139920                                           | 1206227                   | 105,8                             |

*Source:* build by the author

Table data. 5 show that the proceeds from the sale of products for the future in the organizations of the agro-food sector of the Mogilev region will increase by an average of 5.8%.

Figure 2 shows the forecast of revenue from the sale of products of agricultural organizations in the Mogilev region using the Cobb-Douglas production function.

Thus, a comparison of the values of the average, marginal products of labor and the total capital of organizations in the agro-food sector of the Mogilev region makes it possible to justify the distribution of financial resources in order to maximize their payback. The total value of the calculated elasticity coefficients indicates that the expansion of the scale of agro-industrial production will make it possible to obtain a cumulative effect through the modernization of production and the introduction of modern innovative resource-saving and waste-free technologies for processing products.

**Conclusions**

The production potential of agri-food organizations is a complex, dynamic and multi-level category that takes into account the resources, goals and outcomes of their sustainable development. The production potential of organizations in the agro-food sector...
sector is a combination of the maximum capabilities of organizations, due to the available labor resources, fixed and working capital with appropriate technologies for efficient production in order to meet the effective demand of consumers.

Assessment of the production potential of organizations in the agro-food sector is a necessary stage of analysis and management, covering internal processes and factors in order to identify available reserves. To mobilize the available reserves, it is important to have objective data characterizing the efficiency of using both the production potential and each of its structural elements. There are interconnections and interdependencies between the elements of the production potential of organizations, the nature of which is also determined by the transformation of the internal and external environment, therefore, the assessment is carried out both at a specific point in time and in dynamics. When conducting an analysis, attention is paid to internal factors that depend on the activities of organizations, which it is possible to influence, adjust their impact and manage. The main factors of the external environment are: regulatory, economic, technological, social, etc.

As a result, an integrated approach to organizations in the agro-food sector is provided, which allows to substantiate the directions of their effective activity. In the Mogilev region, it is advisable to form a portfolio of investment projects implemented in this area, aimed at creating conditions for the growth of innovative potential and increasing the competitiveness of products. The application of a set of proposed measures will improve the efficiency of using the production potential of organizations in the agro-food sector and ensure their sustainable development in modern conditions.

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