Economic efficiency of producing a complex powdered concentrate for the production of soft drinks

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Abstract. The article deals with the issues about economic efficiency of producing a complex powdered concentrate from grain and fruit and berry raw materials for the producing soft drinks of high nutritional value. The main indicators that characterize the efficiency of producing finished products are calculated. Calculations of the production efficiency of powdered concentrates showed that the profit from the sale of 1 kg of powdered concentrate was from 272.3 to 406.5 rubles, and the profitability of new products is from 40.3 to 42.7 %. Production of powdered concentrate from textured grain and fruit and berry raw materials is expedient and economically profitable production, due to small investments and low production costs.

1. Introduction
The development of the food industry does not stand in place. New technologies make it possible to create new food products while preserving all the useful substances necessary for the human body [1, 2].

The abundance of various substitutes for natural ingredients that reduce the cost of the finished product, easing the financial and technological burden on production, and thus making life easier for producers, leads to a decrease in the level of healthy nutrition for the population.

Therefore, one of the priority areas that can solve the problems of healthy nutrition for the population is the search for new types of plant products, the use of which in the production of food will enrich them with vital substances to the level corresponding to the physiological needs of the body [3, 4].

2. Research methods
This article examines the economic efficiency of developing the production of complex powdered concentrates from textured grain products and fruit and berry raw materials for the production of soft drinks.

When conducting marketing research, it was found that among more than 300 names of products for a healthy diet of various categories (crackers, diabetic bread, muesli, instant cereals); the supply of grain soft drinks is very limited [5, 6]. The market of products enriched with useful microelements and vitamins that are sold in supermarkets, specialty stores, pharmacies, and online stores is developing quite quickly, and their cost ranges from 40 to 670 rubles per 100 grams of product [7].

Research on the development of complex powdered concentrates from plant raw materials for food production is very relevant. The creation of high-quality and highly nutritious powders for creating soft
drinks from plant raw materials is based on the use of new technologies, with the requirement of strict compliance with the parameters of drying and grinding of plant components, which have their own regulations for each type of raw material [8].

We have created a technology of complex powdered concentrates from plant raw materials for the production of soft drinks. As raw materials for textured grain, extruded grains of cereals such as wheat, barley and oats, and the black chokeberry are used. When choosing raw materials, its useful properties were taken into account. The formulation of powdered concentrate from plant raw materials was created taking into account the analysis of the taste qualities of the finished drink.

A new technology for producing complex powdered food concentrates, developed in the course of scientific research, allows you to get drinks from fast-cooking plant raw materials with increased nutritional value. The finished product arouses consumer interest due to the combination of its useful properties, pleasant taste and fast cooking. In addition, the developed technology will increase the economic efficiency of grain processing plants. [Ошибка! Источник ссылки не найден.. 10]

3. Results
When developing new types of food products, it is necessary to take into account existing technologies and competition in this area. To achieve effective introduction of products to the market, it is necessary to minimize the production cost of these products, but the quality and consumer attractiveness of products should not suffer [11, 12, 13]. If at least one of these conditions is not met, then the introduction of a new product will be inefficient, and will be unprofitable [14].

To assess the economic efficiency for the production of powdered concentrates from plant raw materials for the production of soft drinks, technical and economic calculations were carried out.

A review of the raw material market showed that the chokeberry is presented in the price range of 310 - 350 rubles per 1 kg. To calculate the economic efficiency, the average cost of the black chokeberry in the Krasnoyarsk region market is 325 rubles per 1 kg. The cost calculation of the powder from the black chokeberry obtained by freeze-drying is presented in the table 1.

Table 1. Initial data for calculating economic efficiency.

| 0 | Name of indicators                           | Marking | Experimental sample value | source          |
|---|---------------------------------------------|---------|--------------------------|----------------|
| 1 | Workshop productivity per 1 day, hour, kg   | $W_{\text{hour}}$ | 37.5                     | Calculated     |
| 2 | The performance of the shop for a day, kg   | $W_{\text{day}}$  | 300                      | $8 \times W_{\text{hour}}$ |
| 3 | Number of service personnel, pers.          | $\mathcal{N}$ | 3 workers                | Technical characteristic |
| 4 | Daily rate of the worker, rub.              | $3_{TP}^{sp}$ | 530.52                   | Data from the state statistics committee of the Russian Federation |
| 5 | Drying oven power, kW                       | $U$ | 40.0                     | Technical characteristics of the drying oven |
| 6 | Power of the electric motor of the shredder, kW | $U$ | 3.0                      | Technical characteristics of the electric motor of the shredder |
| 7 | Mixer electric motor power, kW              | $U$ | 7.5                      | Technical characteristics of the mixer motor |
| 8 | Electric motor power of the packaging machine, kW | $U$ | 2.5                      | Technical characteristics of the packaging machine |
| 9 | Standard coefficient of efficiency of capital investments | $E_H$ | 0.28                      | Methodology for determining effectiveness |

Drying of the black chokeberry is carried out by freeze-drying method in a leophilic dryer CX TEK10 with a power of 100 kg, 1 drying cycle lasts 12 hours.
The production of food concentrate is provided in a mini-shop consisting of a module with the size of 7*9*6.7. The module contains scales, a drying oven, equipment for grinding dry raw materials, sieves for calibrating the resulting powder, and equipment for packaging finished powdered concentrates. The cost of a mini-shop using a module with a set of technological equipment is 2800 thousand rubles.

The price of the finished product is formed taking into account the growing market demand. Market analysis allows you to determine the price of finished powdered concentrate at the level of 1180.00-1415.0 rubles per kg.

Table 2. The cost of the powder from the fruit of the black chokeberry.

| Indicators                                              | Value  |
|---------------------------------------------------------|--------|
| Cost of raw materials per 1 kg, rub.                    | 325.00 |
| The cost of the drying process for 1 kg of the black chokeberry, rub. | 352.00 |
| Weight of 1 kg of the black chokeberry after drying, kg | 0.45   |
| Cost of 1 kg of the black chokeberry powder, rub.       | 1504.44|

From previous studies, it is known that the cost of 1 ton of powder from extruded wheat is 16113.9 rubles, which is 16.11 rubles per 1 kg, powder from extruded barley grain is 14945.2 rubles, so 14.94 rubles per 1 kg, and powder from extruded oat grain is 12894 rubles, equal to 12.89 rubles per 1 kg [15, 16].

The price of the finished product is formed taking into account the growing market demand [17]. Market analysis allows us to determine the price of finished powder from the black chokeberry at the level of 1504.44 rubles per kg (table 2).

The main necessary economic indicator is the cost of production, which acts as the sum of monetary costs for the production and sale of products and is a generalizing indicator along with profit, characterizing all aspects of the enterprise's activities in the relationship [14, 18, 19].

The main physical and economic indicators that form the cost of the finished powdered concentrate are presented in the tables 3 - 5.

Table 3. Basic physical and economic performance of a powdered concentrate made from extruded wheat and black chokeberry.

| Indicators                                              | Value  |
|---------------------------------------------------------|--------|
| Cost of 1 kg of extruded wheat powder, rub.             | 16.11  |
| The cost of 1 kg of powder from the black chokeberry, rub. | 1504.44|
| Required weight of extruded wheat powder, kg            | 1.0    |
| The required weight of the powder from the black chokeberry, kg | 2.0    |
| Total cost of powder concentrate, rub.                  | 3024.99|
| Cost of 1 kg of finished products, rub.                 | 1008.33|

The cost of 1 kg of finished powdered concentrate from extruded wheat and black chokeberry is 1088.33 rubles (table 3).

Table 4. Main physical and economic indicators for powdered concentrate from extruded barley grain and black chokeberry.

| Indicators                                              | Value  |
|---------------------------------------------------------|--------|
| Cost of 1 kg of extruded barley powder, rub.            | 14.94  |
| The cost of 1 kg of powder from the black chokeberry, rub. | 1504.44|
| Required weight of extruded barley powder, kg           | 1.0    |
| The required weight of the powder from the black chokeberry, kg | 1.5    |
| Total cost of powder concentrate, rub.                  | 2271.6 |
| Cost of 1 kg of finished products, rub.                 | 908.64 |

Based on the calculations given in table 3, the cost of 1 kg of finished powdered concentrate from extruded barley and the black chokeberry is 908.64 rubles.
Table 5. Basic physical and economic performance of a powdery concentrate of extruded grain oats and the black chokeberry.

| Indicators                                                      | Value     |
|----------------------------------------------------------------|-----------|
| Cost of 1 kg of extruded oat powder, rub.                       | 12.89     |
| The cost of 1 kg of powder from the black chokeberry, rub.      | 1504.44   |
| The required mass of powder is extruded oats, kg               | 1.0       |
| The required weight of the powder from the black chokeberry, kg | 1.5       |
| Total cost of powder concentrate, rub.                         | 2269.55   |
| Cost of 1 kg of finished products, rub.                        | 907.82    |

According to table 5, the cost of 1 kg of finished powdered concentrate from extruded oats and the black chokeberry is 907.82 rubles.

Based on the data provided in tables 2-5, it can be concluded that the production of powdered concentrate from the studied raw materials is an appropriate and economically profitable production, due to small investments and low production costs.

Production efficiency is characterized by such cost indicators as the cost of finished products, profit from sales of finished products, profitability of production and profitability of products sales [20, 21]. The calculations results of the economic efficiency for production of powdered concentrate are shown in the table 6.

Table 6. Economic efficiency indicators of powdered concentrate production.

| Indicator                               | A type of concentrate |          |          |
|-----------------------------------------|-----------------------|----------|----------|
|                                        | from extruded wheat and black chokeberry | from extruded barley and black chokeberry | from extruded oats and black chokeberry |
| Cost of 1 kg of commercial products, rub. | 1414.82               | 1281.23  | 1295.23  |
| Cost of 1 kg of powdered concentrate, rub. | 1008.33               | 908.64   | 907.82   |
| Profit from the sale of 1 kg of commercial products, rub. | 406.49               | 372.59   | 272.34   |
| Production profitability, %             | 40.3                  | 41.0     | 42.7     |
| Profitability of sales, %               | 28.7                  | 29.1     | 29.9     |

After analyzing the economic efficiency indicators for production of powdered concentrate from various types of raw materials, we note that the profit from the sale of 1 kg of powdered concentrate from extruded wheat grain and black chokeberry will amount to 326.49 rubles at the cost of the finished powdered concentrate of 1008.33 rubles and the profitability of production of 40.3 %.

When selling 1 kg of powdered concentrate from extruded barley and black chokeberry at a price of 1281.23 rubles, the profit will be 372.59 rubles per 1 kg, and the profitability is 41.0 %.

The sale of 1 kg of powdered concentrate from extruded oat grain and black chokeberry for 1,295 is 23 rubles will make a profit of 272.34 rubles at a cost of 907.82 rubles and the profitability of production will be 42.7 %.

Based on the data shown in table 6, it can be concluded that the production of powdered concentrate from plant raw materials for the production of fruit and grain soft drinks is an appropriate and economically profitable production; the profitability of production was from 40.3 to 42.7 %.

4. Conclusion

The raw material for obtaining powdered concentrates is plant raw materials grown on the region of the Krasnoyarsk region; its use in the implemented technologies solves the problem of added value. The profit from the sale of products manufactured using the new technology increases; the profitability is up to 42.7 %, so the implementation effectiveness of the developed technology is proven.
Powdered concentrates from textured grain and fruit and berry raw materials for the production of soft drinks have an increased nutritional value and can largely solve the problem of improving the nutritional status, providing all the useful substances to the level corresponding to the physiological needs of the body.

References
[1] Durnev A D and Oganesyants L A 2007 Functional food product Storage and processing of agricultural raw materials 9 15-21
[2] Antamoshkina O, Zinina O and Olentsova J 2019 The optimization of business processes at the enterprises of agro-industrial complex 19th International Multidisciplinary Scientific GeoConference SGEM 2019 International Multidisciplinary Scientific GeoConference SGEM. 19(5.4) 863-8 DOI: 10.5593/sgem2019/5.3/S21.109
[3] Rubtsova L I, Timoeeva V A and Dashkevich M V 2002 Handbook of the seller of food products: textbook (Rostov on the Don "Phenix") p 416
[4] Nezamova O A and Olentsova J A Adaptation problems of the food market to modern conditions IOP Conf. Ser.: Earth Environ. Sci. 548 082023
[5] Nezamova O A and Olentsova J A 2020 Monitoring Consumer Behaviour in the Food Market in the Krasnoyarsk Region of Russia International Conference on Efficient Production and Processing (ICEPP-2020) E3S Web of Conferences 161 01080
[6] Antamoshkina O I, Zinina O V and Stupin A O 2019 Method of forming the program of issue of competitive products of machine-building industry IOP Conf. Ser.: Mater. Sci. Eng. 862 042029
[7] Sandrakova I V and Reznichenko I Yu 2019 Research of consumers of healthy food products Practical marketing 12 (274)
[8] Morgun V A 1991 Improving the baking qualities of flour (K.: Crop) p 136
[9] Yanova M A, Oleynikova E N, Sharopatova A V and Olentsova J A Increasing economic efficiency of flour production from grain of the main cereal crops by extrusion method IOP Conf. Ser.: Earth Environ. Sci. 315 022024
[10] Yanova M A, Sharopatova A V and Roslyakov Yu F Introduction of innovative technology for the production of textured products from grain raw materials IOP Conf. Ser.: Earth Environ. Sci. 548 022104
[11] Stepanova E V 2020 Export orientation of agribusiness enterprises in the region IOP Conf. Ser.: Earth Environ. Sci. 421 032047
[12] Zinina O and Olentsova J Evaluating the Effectiveness of Company Development in Processing Industry International Conference on Efficient Production and Processing (ICEPP-2020) E3S Web of Conferences 161 01074
[13] Zinina O V, Dalisova N A and Karaseva M V 2020 B2B sphere as an element of the exports potential development in the agricultural sector of the region IOP Conf. Ser.: Earth Environ. Sci. 421 022012
[14] Bogatyrev A N, Panfilov V A and Tuzhilkin V I 1995 System of scientific and engineering support of food and processing industries of agriculture in Russia (Moscow: Food industry)
[15] Yanova M A and Oleynikova E N 2017 Calculation of economic efficiency of flour production from barley extrudate Proceedings of the V international scientific and practical conference bakery, confectionery and pasta of the XXI century (Krasnodar) 382-3
[16] Yanova M A and Oleynikova E N 2019 Economic efficiency of flour production from extruded grain of the main cereal crops Proceedings of the scientific and practical conference dedicated to the 90th anniversary of VNIIZ (Moscow) 425-30
[17] Rozhkov A V and Olentsova J A 2019 Regional Support of Small Business in the Agriculture Sphere of the Krasnoyarsk region International scientific conference “New Silk Road: business cooperation and perspective of economic development – 2019” (Czech Technical University in Prague, MIAS School of Business, Czech Republic)
[18] Zinina O V and Olentsova J A 2020 Elements of sustainable development of agricultural enterprises *IOP Conf. Ser.: Earth Environ. Sci.* **421** 022003

[19] Antamoshkina O I and Zinina O V 2019 A methodology for assessing the prospects of modifying business strategy of an enterprise in the external environment *IOP Conf. Ser.: Mater. Sci. Eng.* **537** 042023

[20] Rozhkova A V and Stepanova E V 2020 Resource Saving Technologies at Rapeseed Growth at Region of Russia *International Conference on Efficient Production and Processing (ICEPP-2020), E3S Web of Conferences* **161** 01075

[21] Ozerova M G, Sharopatova A V and Olentsova J A 2019 Improving the competitiveness of agricultural products as a basis for solving import replacement issues *IOP Conf. Ser.: Earth Environ. Sci.* **315** 022026