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Prospects for development of organic crop production and its impact on the ecology of the region

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ABSTRACT

The relevance of the research topic is due to the fact that in the modern world, society is increasingly paying attention to environmental problems and the population is concerned about healthy nutrition. Excessive intensification in crop production, increasing demand for organic products, and support of public health force society to take a new look at organic agriculture and its impact on the ecology of the region. The study's results allowed us to determine that producing organic products contributes to preserving ecosystems and reduces the negative impact on the environment. The article presents the stages of development of organic farming in the world and the features of its development in the region (based on the materials of Siberia). Based on SWOT analysis, strengths and weaknesses were identified as opportunities and threats to the development of production and market of organic crop products. The largest producers and suppliers of organic products to the market have been identified. Additionally, the principles of organizational and economic mechanisms of development of the organic products market have been proposed, as well as measures that contribute to its development on the main elements of the market: supply and demand for organic products, competition, and export. Moreover, the main components of the growth of organic crop production in Siberia, considering the region's peculiarities, are also identified. Furthermore, a cluster model for producing organic products in the Novosibirsk region has been developed. In addition, a cognitive approach model aimed at increasing demand for organic products and preserving the region's ecosystem is presented. Based on the research results, directions and measures to promote the development of organic production in the region are identified. A cognitive approach model aimed at increasing demand for organic products and preserving the ecosystem was developed.

Keywords: Cognitive approach, Organic products, Siberia, Ecology, Export.
Article type: Research Article.

INTRODUCTION

In the context of contemporary economic conditions, global intensification of agriculture, aimed at solving food security issues, has caused the emergence of environmental problems and negative impact on health when consuming produced products. Using mineral fertilizers and pesticides depletes the soil, disturbs its structure, and makes it more vulnerable to wind and water erosion. Some fertilizers contribute to soil acidification, negatively affecting plant growth (Kuzyakov 1997). Pesticides accumulate in the soil and enter water bodies, rendering them unsuitable for flora and fauna. This leads to disruption of the food chain and reduction of biodiversity. Agrochemicals destroy not only pests but also beneficial insects and birds that regulate the number of pest populations. The production of mineral fertilizers and pesticides is accompanied by greenhouse gas emissions, which lead to climate change. This affects the growing season's duration and increases the frequency and extent of extreme weather events (drought, floods, storms, etc.), erosion, changes in soil pH, and the formation of solonetz and saline soils. Climate change spreads pests and diseases to the new territory, reducing yields and

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product quality. Pesticides and other chemicals accumulate in the human body, leading to various diseases, such as cancer and reproductive system problems. The way out of the situation is seen in the transition to more sustainable and ecological methods of farming, such as organic farming (refusal of synthetic pesticides and mineral fertilizers, use of biological methods of plant protection, compost and other fertilizers, preservation of soil fertility, creation of closed systems), agro-ecological practices (sowing shifts, sowing of siderates, direct seeding), increasing the efficiency of resource use and minimizing transaction costs. The main objective of the research was to determine the prospects for developing organic crop production and its impact on the environment. The study was conducted in 2022-2023 on the territory of the Siberian Federal District.

In order to achieve the goal, the objectives are set and solved:

- the possibilities of developing the production of organic crop products have been identified;
- the producers of organic products of Siberia, forming the architecture of growth, have been identified;
- new principles of the organizational and economic mechanism for the development of the organic products market are proposed;
- a model of a cluster producing organic products has been developed;
- a model of a cognitive approach is proposed aimed at generating demand for organic products and preserving the ecosystem of the region;
- directions and measures have been identified to ensure the development of crop production of organic products.

Empirical studies have shown increasing demand for organic products, including in developing countries (Boora *et al.* 2021), that over-intensification in agriculture contributes to developing production and market for crop organic products. Organic crop production has socio-economic and environmental effects, enhancing biodiversity and soil health. It also contributes to resource allocation, adoption, and dissemination of local food systems (Reganold & Wachter 2016; Shchepeleva *et al.* 2016; Bentsen & Pedersen 2021; Eyinade 2021). The production of organic products has been developed in 191 countries. From 1999 to 2021, the world's agricultural land under organic agriculture increased 6.6 times to 72.3 million hectares and accounted for 1.6% of all world agricultural land. Australia has the largest area (35.7 million hectares), followed by Argentina (4.1) in South America and France (2.8) in Europe. An increase in the production of organic products has grown the market, which will reach USD 134.8 billion by 2022. This includes the United States at USD 58.6, Germany at 15.3, China at 12.4, and France at USD 12.0 billion. Europe imports up to 75% of organic produce to meet the growing demand (Wintermantel *et al*. 2019). Organic products are in demand because they are associated with environmental care and are considered to be of high quality, safe, and sustainable (Rana & Paul 2020; Sugar & Brscic 2020), especially vegetables, fruits, cereals and grains, and olive oil (Sugar & Brscic 2020). Per capita consumption worldwide is 15.7 euros, with the highest values in Switzerland at 425, Denmark at 365, Austria at 274, and Luxembourg at 259. For 2012 - 2020, the annual growth rate of organic production was more than 10% per year, and for 2021 - 2023, it decreased to 4-5%. However, the growth rate of organic product consumption exceeded the growth rate of their production twice. Grand View Research forecasts that the organic market will continue to grow and reach USD 564 billion by 2030. In Russia, organic product production began to develop in the 2000s. The creation of the Union of Organic Agriculture and the National Organic Union gave the impetus for developing this area. During this period, organizations began to appear in Russia, with the advent of production facilities operating according to foreign standards. In Russia, organic agricultural products are defined as environmentally friendly and have been grown on the territory without agrochemistry during the last three years. It is precisely such products that the Ministry of Agriculture of the Russian Federation certifies as organic. If the products were grown on soil without their use during the last three years before harvest, the ministry certifies food products as organic (Polzikov *et al.* 2023). In Russia, entrepreneurs, based on foreign experience, are trying to actively develop the production of organic products. They face the difficulties of market development and understanding of their essence. Therefore, it is necessary to conduct informational and educational activities corresponding to "green education," which will ensure the growth of production and demand by reducing the price. In the middle of 2022, 193 companies produced organic products in Russia, including 105 certified by the Ministry of Agriculture of the Russian Federation and 88 according to foreign standards. Most of the producers grow organic crop products (Nemes 2009). Since the demand for it in the domestic market is consistently low, these products are exported. The strategy for developing organic production in the Russian Federation until 2030, as the most relevant direction of greening the agro-industrial complex indicated that its volume by 2030 will reach 150 billion rubles. One of

the most promising regions of Russia for developing organic crop production is the Siberian Federal District (Siberia). Firstly, there is a high resource potential here, the basis of which is 6.59 million hectares of unused agricultural land, including the Novosibirsk Region – 2.3 million hectares, Omsk – 1.4 million hectares and the Krasnoyarsk Territory – 1.3 million hectares. Secondly, extensive farming technologies have become widespread. The region is characterized by a fairly low level of mineral fertilizer application. However, the transition to intensification in 2018-2021 led to an increase in the application of the active substance from 119.0 to 330.5 thousand tons per 9.1 million hectares of arable land. Thirdly, there is a low concentration of polluting industrial production in agricultural territories. Fourthly, selling products in the agro-food market is an unsolvable problem. The active development of organic crop production can have a positive socio-economic and environmental effect on the region's economy.

MATERIALS AND METHODS

The information base of the study was formed by the works of scientists of research institutions of the Russian Academy of Sciences, information of Forschungsinstitut für biologischen Landbau (FiBL) and the Union of Organic Agriculture. During the study, the following methods were used: monographic - in the study of the organic crop production; statistical and conjunctural study - in the study of the peculiarities of development of organic production in the region (on the materials of Siberia); expert assessments and survey - in the expert interpretation of the obtained data and their systematization and identification of opportunities for growth of organic production; abstract-logical - in the development of an organizational and economic mechanism of production development model.

When studying the prospects of development of organic crop production and its impact on the ecology of the region, we conducted an expert assessment with the subjects of the agri-food market of Siberia represented by representatives of the authorities, business (producers, processing enterprises, marketing organizations, production and marketing infrastructure, transport and logistics companies) and consumers.

The general population of respondents who participated in the evaluation was identified.

$$n = 1 / (\Delta 2 + 1/N), \quad (1)$$

where «n» is the sampling population;

Δ - allowable error (usually 5%);

N is the volume of the general totality.

Sample by respondents as of January 1, 2023

n = 1 / (0.052 + 1/16646000) = 400 respondents.

Then we conducted a study, the results of which are presented in the form of a SWOT matrix (Table 1).

The strengths of developing organic crop production are that Siberia has rich natural resources, low population density, and a relatively clean environment, which creates favorable conditions for organic farming. The basis for the cultivation of organic crops is the varieties developed by scientists, black soil and other fertile soils suitable for cultivation, the growing demand for organic products, and the possibility of exporting them.

The areas for improvement of production development are significant financial investments, which prevent the emergence of small farmers and entrepreneurs in this market segment. In Siberia, a developed system of sales channels for organic products has yet to be developed, which can complicate its sales and marketing (Bykov *et al.* 2022).

Table 1. SWOT- analysis of organic crop production development in Siberia.

Strengths sides	**Weak sides**
1. Quality environment 2. Fertile soils 3. Availability of varieties 4. Demand for products	1. Lack of well-developed infrastructure, centers for organic farming, laboratories for product analysis, training and consultations for producers. 2. Lack of financial resources among small producers 3. Lack of sustainable sales channels 4. Lack of specialists with experience and knowledge in organic farming
Opportunities	**Threats**
1. Development of government support 2. Creation of new markets, including access to interregional and international markets 3. Development of agrotourism and ecological tourism 4. Introduction of innovative technologies	1. Climate change 2. Competition from traditional-bond agriculture 3. Lack of qualified personnel 4. Lack of information

Note: Compiled by authors.

Opportunities for developing organic crop production in Siberia in the near future will be determined by the degree of financial and institutional support and the development of innovative technologies, such as precision farming, which can increase the efficiency of organic farming and reduce costs. Among the threats, we highlighted climate change, contributing to droughts and floods' increased frequency and intensity. Conventional agriculture offers the market products at lower prices, which, with low purchasing power, creates competition in the organic market. In Siberia, there needs to be more information about organic farming products and specialists with experience and knowledge, which can complicate decision-making on the introduction of organic farming. Effective decision-making in the market is hampered by a lack of information and the competence of subjects capable of processing it and making effective management decisions. Despite the fact that Siberia has accumulated great potential for the production of organic products, a number of problems do not need to be solved. It is necessary to strengthen government support, develop infrastructure, train personnel, create sustainable marketing channels and inform the population about the benefits of organic products. If these problems are solved, organic crop production in Siberia can become an important factor in the region's development and improve the population's quality of life.

RESULTS AND DISCUSSION

The production of organic products is of particular socio-economic and environmental importance (Kundius, 2023). Since it contributes to the preservation of ecosystems, this has led to the need to change theories of economic growth, where the problems of growth become inseparable from the concept of "responsible consumption". We have grouped modern theories of economic growth and emphasized the essence of their content (Table 2).

Incorporating the concept of "responsible consumption" into the theory of economic growth allows us to draw conclusions about:

- the need to transition to sustainable economic growth without depleting natural resources and deteriorating the quality of the environment;
- the increase in the investment on green technologies as a key factor for sustainable economic growth;
- The role of responsible consumption based on sustainable nutrition and consumption of environmentally friendly products is an important factor in improving the quality of life and achieving sustainable economic growth.

Currently, researchers consider the production of organic crop products a production system adapted to the conditions of the region, based on environmental processes in conditions of uncertainty and risks. This requires scientific approaches and innovative industry development based on using intensive and SMART technologies (Kundius 2023).

Table 2. Modern economic theories of growth.

№	Name of the theory	Content of the theory
1	Strong resilience	Recognizing the need to consider the limited nature of natural resources and the impact of economic activity on the environment. It calls for a transition to a model of economic development that ensures economic growth, preserves natural resources, and improves the quality of life for future generations. The priority is direct regulation
2	Weak resilience	Focuses on conditions under which future generations will have no less opportunity to meet their needs. Recognizes the need for investments that compensate for the loss of natural capital and ensure sustainable consumption. Utilizes ecological-economic tools.
1	Green technologies	Emphasis is placed on the introduction of environmentally friendly technologies to reduce pollutant emissions and resource consumption, increasing production efficiency.
2	Green economy	Transition to an economic development model focused on preserving natural resources and improving the quality of life through green business development
1	Quality of life	Responsible consumption, based on rational eating, the use of environmentally friendly products, and a healthy lifestyle, is a key factor in improving quality of life.
2	Consumption theory (as a theory of social well-being)	Examines the principles of rational buyer behavior in the marketplace and explains how he or she makes choices of market goods.

Note: Complited by authors.

Despite the dynamic development of the organic market in the last decade, it is not correct to call organic agriculture a new direction. Its development has gone through a number of stages:

- the first stage (1924-1970), the origin of organic agriculture, when standards for quality control of organic products were defined;

- The second stage (1970-1990) was the identification by laboratories of the negative impact of agrochemicals on the ecosystem, the creation in 1972 of the International Federation of Movements for Organic Agriculture (IFOAM), and the development of production standards. A total of 93 States have their legislation and standards governing the organic market. However, a single global standard has not been adopted.

The third stage (1990—present) involves the creation of associations and companies for the sale of organic products (Organic Trade Associations OTA, Australian Organic, FederBio, others), the approval of the principles of organic agriculture (at the IFOAM General Assembly), and the transition to a new stage of development of Organic 3.0 (November 2017). Science has proved and practice has confirmed that the technologies used in conventional farming have a negative impact on the environment (U.S. Department of Agriculture). However, this technology has a significantly higher yield per unit of acreage. Countries with high production intensification, high income, and increased attention to health have a higher demand for organic products. For example, in Russia in 2015-2022, the application of mineral fertilizers increased by 70.6% and amounted to 3,432 thousand tons. However, in Europe and China, this indicator is 3-5 times higher than the average for Russia (Russia – 74 kg of d. in /ha of crops, China – 364, Great Britain – 247, Poland – 202, kg of d. in /ha of crops). The largest areas under crops in organic agriculture are cereals and citrus. The occupied area under organic cereal crops is 3481 thousand hectares (in China 1425; Germany 384.0; France, 371.7; Canada, 371.2; USA 290.3; Spain 241.9 and Russia 212.8 thousand hectares; Willer *et al.* 2023). In 2021, in the organic market, there are 3.7 million producers, more than 118 thousand processors and 8.4 thousand importers, most of them are registered in Europe (Table 3; Willer *et al.* 2023). Liechtenstein has the highest market share of organic products, with 40.2%, Samoa 29.1%, and Austria 26.5%.

Table 3. Main indicators characterizing organic farming and the organic market.

Region	Certified organic agricultural land (mln. ha)		Producers (mln.)	Market volume (billion euros)	Exports to the USA and Europe (th. tons)	Exported products
	2020	2021				
Africa	2.3	2.7	1.12	n/a	460	Cocoa, coffee, olives, nuts, oilseeds, etc.
Asia	n/a	6.5	1.8	13.7	674	Oilseeds, rice, medicinal plants, sugar, spices, nuts, seaweed, etc.
Europe	17.0	17.8	0.44	54.5	-	-
Including Russian Federation	n/a	0.66	-	-	-	Wheat, flax, sesame seeds, barley, rye, spelt, beans, lupin, rapeseed, peas
Latin America	9.94	9.87	0.11	n/a	2662.3	Bananas sugar, coffee, cereal, cocoa, etc.
North America	n/a	3.5	0.0234	57.5	180.3	Cereals, fruits, sugar, dry beans, coffee, oils and fats, etc.
Australia, New Zealand and Oceania	n/a	36.0	0.018	1.87	30.0	Coffee, coconut, cereals, fruit, etc.

Note: compiled by the authors according to Willer *et al.* (2023).

Organic products are produced mainly on farms with an area of 50-1500 ha (in EU countries, 20-25 ha). The main advantages of organic production are to solve problems (Fig. 1).

The study found that the organic market size was more than 130.0 billion USD (Willer *et al.* 2023). At the beginning of 2022, 655.5 thousand hectares were under organic farmland, and the number of producers increased to 146 companies.

In 2022, organic production will be established in the Volga Federal District, Primorsky Krai, Nizhny Novgorod, and Leningrad Oblasts. However, our research showed that Siberia has a high potential in organic production in Altai and Krasnoyarsk Krais, Novosibirsk, and Omsk Oblasts. In our research on Siberia, we have identified features of the development of organic farming and organic crop production (Table 4).

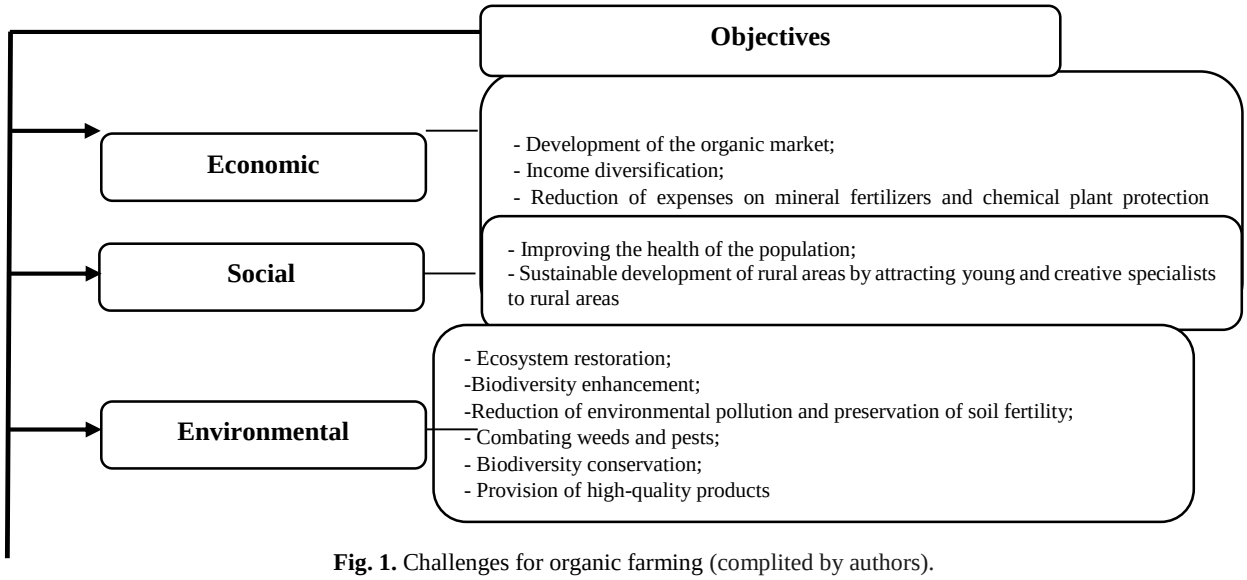

Fig. 1. Challenges for organic farming (complited by authors).

Table 4. Features of development of organic farming and organic crop production in Siberia.

Organic farming
1. Diverse natural and climatic conditions determine organic farming methods that should be adapted to different natural and climatic zones. 2. Unfavorable climatic conditions for organic farming, which can be overcome with the help of greenhouses, choice of varieties and methods of extending the crop season, other methods of plant protection. 3. The process of certifying organic products is very complex and requires significant expenses, which can be a challenge for small farms. 4. Application of modern technologies in organic farming contributes to the growth of yields and efficiency of processes, preservation of soil, water resources and biodiversity, which is especially important for the ecosystem of the region.
Organic production
1. The annual growth in demand for organic products is driven by the development of the information field, the emergence of a "smart" consumer who cares about their health and makes conscious choices. 2. The disparity in the geography of production and consumption of organic products, necessitates the development of regional and interregional links. 3. Conservatism and limited rationality in producer decision-making is inextricably linked to incomplete information, which complicates the development of the organic market. 4. Commodity diversification occurring under price pressure. 5. The structure and volume of demand for organic products is determined by the type of food and solvent demand. 6. Government support for producers in certain regions in the form of subsidies, incentives, and other measures. 7. The regional organic market should not be considered in isolation from the national and international market due to its integration. 8. When products are sold for export, a significant part of budget revenues at different levels and a positive image at the international level are formed. 9. Conservatism, limited rationality, and market participant behavior are characterized by a high degree of opportunism, leading to the emergence of information asymmetry and complicating economic interaction between market participants 10. The cognitive approach contributes to the formation of efficient production and allows the creation of potential buyers with identical cognitive system in the market.

Note: complited by authors.

The identified features affect the development of organic crop production, which should be considered in the planning and development of this industry. In Russia, unlike Europe, the architecture of organic market development is formed by large agricultural enterprises. According to FIBL research, the area of certified organic enterprises averages 3,400 hectares, and the organic market share is 0.5% (Willer *et al.* 2023). Large producers will form production of organic products in Siberia in the next five years. Given the principles of organic agriculture approved at the IFOAM General Assembly, we propose building an organizational and economic mechanism based on safety and environmental friendliness, health, proportionality, balance, and marketing (Table 5).

Table 5. Principles organizational and economic mechanism of organic production.

Principle	Table of Contents
Environmental friendliness and safety	- Minimizing the negative impact on the ecosystem by avoiding synthetic chemicals and using biological methods of plant protection and fertilizers that take advantage of biodiversity and soil fertility; - Maintaining high yields by applying environmentally safe means and technologies, improving agroecosystems, biological cycles and soil biological activity.
Complexity	- Consideration of competition in the market and changes in market conditions
Balances	- Supporting the balance of supply and demand for organic products through price regulation and other government measures
Proportionality	- Compliance with the proportions between supply and demand, market segment structures, the essence of which is to regulate the conditions for the organic market to fulfill its economic and regional functions.
Economic efficiency	- Organic produce is sold at higher prices, providing the producer with additional income; - Creation of new markets with the formation of increased demand for organic products; - Opportunity to differentiate products and increase their competitiveness in the market; - Organic certification helps to create a brand that is different from conventional products.
Social responsibility	- Ensuring fair wages; - Engaging with suppliers of materials and services that are consistent with environmental and economic development principles. - Creating jobs and improving the living conditions of the population.

Note: Complited by authors.

According to our estimates, for the development of organic production in Siberia, up to 2 million hectares can be additionally put into circulation (Table 6).

Table 6. Development potential of organic products in Siberia.

	Options for forming territorial associations	The area of unused arable land at the beginning of 2020
Subject of the Russian Federation	**organic**	**thousand hectares**
Altai Republic	-	32
Republic of Tyva	-	131
Republic of Khakassia	-	239
Altai Territory	+	829
Krasnoyarsk Territory	+	737
Irkutsk region	+	295
Kemerovo region	+	147
Novosibirsk region	+	561
Omsk region	+	110
Tomsk region	+	126

Note: By the authors for the Regions of Russia 2022 Socio-economic indicators.

The development of the organic products market in Siberia should be carried out considering the peculiarities of its production in the region. Its basis for effective development includes:

- sufficiently high soil potential (chernozem and other soils) for production;
- low level of agrochemistry application;
- adoption of targeted programs, including subsidies and grants aimed at supporting producers;
- development of educational programs aimed at training highly qualified world-class specialists
- formation of the brand "Siberian Organic Product";
- development of new varieties adapted to natural and climatic conditions;

State support for organic producers should be short-term (1-2 years) to not create an artificial competitive advantage for these products. The manufacturer should be able to enter the market with a new product during this period. Applying a cognitive approach should ensure the increased demand of the population for organic products (Table 7).

Table 7. Directions and measures promoting the development of crop organic production.

Direction	Measures
Organic production	- the choice of location of organic products and their varietal diversity, allowing for more efficient production activities; - Use of non-chemical seed treatment methods to control seed-borne diseases; - government support, including preferential taxation and free certification of organic production by ANO "Russian Quality System"; - entering into futures contracts; - training of qualified personnel.
Organic processing	- use of raw materials with high quality characteristics; - absence of heavy metals and other harmful substances in the product content; - delivery in environmentally friendly packaging that complies with storage conditions and has a standardized logo with the word "organic" or other similar form; - improving the competencies of employees in the field of organic products;
Demand for organic grain products	- Creating consumer motivation to purchase organic products; - increase in the income level of the population; - Applying a cognitive and marketing approach to the marketplace.
Exports	- compensation of costs for certification of export products; - subsidizing transportation costs; - harmonization of domestic standards with the requirements of importing countries; - support in the creation of an export-oriented cluster of organic grain products.
Competition	- incentivizing regional producers to introduce new agro-technologies aimed at increasing yields and improving economic efficiency.

Note: complited by authors.

The cognitive approach aims to increase consumer motivation (Fig. 2). We believe that a new cognitive concept should be developed to facilitate the formation of potential consumers of organic products with an identical cognitive system. Cognitive technologies involve using digital technologies, including artificial intelligence, to make effective informed decisions. Based on the identified features of production and market activity in the grain market produced by organic technologies in Siberia, it is necessary to ensure the implementation of recommendatory measures (Table 8).

Table 8. Prerequisites for application of the cognitive approach in the market of organic products of its processing in Siberia.

Prerequisite	Place and consequence
1. The needs for organic products are not met.	The market is creating new needs for organic products, technologies, etc. This creates the need to accustom the consumer to a certain style of consumption. This creates the need to accustom the consumer to a certain style of consumption.
2. Increased competition in the market, differentiation of organic products,	Increased competition arises when entering the US and EU markets. The difficulties are aggravated by a rather weak level of infrastructure development and protectionism of importing countries. In this regard, it is necessary to improve methods of communication and influence on consumers.
3. Increased need for knowledge and reliable information.	It is difficult for a market actor to process the growing flow of information. Cognitive technologies, including artificial intelligence, should be applied to make more rational decisions.
4. The subject's behavior becomes less rational.	Changes occurring in the subject's consciousness change his behavior, and the development of information flows makes consciousness more stereotyped and vulnerable.
5. The subject's behavior is characterized by high opportunism and conservatism	Opportunistic behavior and conservatism are associated with incomplete information and cognitive distortions, which leads to information asymmetry and complicates economic interaction of subjects in the market.

Note: complited by authors.

The successful development of organic production can be achieved through the integrated use of theories - concepts of innovative development and cluster mechanism (Fig. 3). Integration of subjects based on a cluster provides the concentration of financial, technological, innovative, and labor resources that contribute to economic growth and consist in the growth of market power, rational use of material and technical base, the presence of shared infrastructure, the ability to manage risks, reduced uncertainty and better awareness. In 2018, for the first time in Russia, the Association of Organic Producers and Exporters was established in Siberia (Tomsk region). It includes 13 certified organic producers interacting with LLC "SibBioProduct," part of the agricultural holding "TDS-group": LLC "Agro," LLC "Perovskoye," and KFH Petrochenkova I.M., producers of grain crops from the Krasnoyarsk and Novosibirsk regions. LLC SibBioProduct, founded in 2014 in Tomsk, has 14 thousand hectares and continuously works with research institute laboratories.

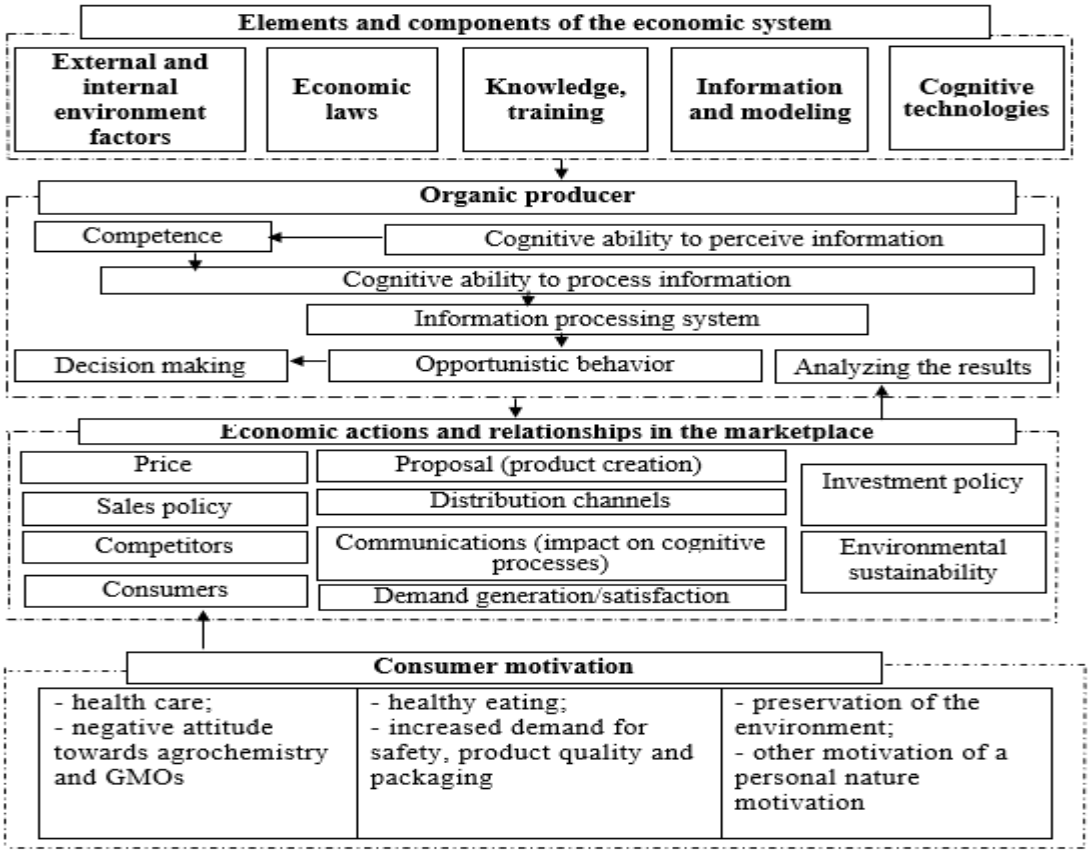

Fig. 2. Model of a cognitive approach aimed at increasing demand for organic products and preserving the region's ecosystem (complited by authors).

The development of organic production in Altai Krai is promoted by significant areas of agricultural land, qualified labor force, high ecological rating and sales market (sanatorium-resort zones, rural tourism). However, the transition to the production of organic products has practically stopped, and four organizations have certificates for their production: LLC "FROM WILD" (Biysk district) - production of wild fruits (processing of pine nuts); LLC "Stepnoy", 4.8 thousand hectares (Biysk district) - production of cereals and leguminous crops; LLC "Kurai Agro Plus" - production of cereals; LLC "Itkulsky Spirtzavod" - production of organic vodka brand "ZernaSevera" (Kundius 2023). As a result of the interaction of entities in the domestic market, the market of organic products in Russia can increase from 12 to 250 billion rubles, increasing the share in supplies to the world market up to 2025 to 2.5% and in the long term up to 10%. In 2021, the export of organic products in Russia was engaged in 15 organizations. Potential markets for organic products are remote, which restrains the inflow of investment in the industry. For the development of production, especially at the formative stage, it is necessary to attract scientists from the Siberian Federal Scientific Center of Agrobiotechnologies of the Russian Academy of Sciences (SFSCA RAS); Institute of Cytology and Genetics of the Siberian Branch of the Russian Academy of Sciences, Novosibirsk State Agrarian University, and others. For the development of the grain market it is necessary to form on the platform of the Association "Siberian Grain Consortium" a center for providing services - consulting, information support and solutions to other issues. Thus, the presented research results have a number of advantages compared to the studies conducted by other authors. The research methodology used by the authors made it possible to determine the peculiarities of the development of organic production in Siberia. Production of organic products in Siberia provides social, economic, and environmental benefits (Schunko *et al.* 2019) and contributes to the development of the region's food systems (Reganold & Wachter 2016; Bentsen *et al.* 2021; Pedersen 2021; Eyinade 2021). The research confirmed the growing demand for organic products and determined that the population considers such a product to be more harmless (Wound & Gender 2020; Sugar & Besic 2020). If earlier Russian producers did not fully understand the essence of the organic products market, now they are

well aware and understand what, to whom, how, and how much to produce. In Siberia, as in Russia, most producers are still mainly engaged in the production of crop products (Nemes 2009). Summarizing everything written above, the modern economic theories of growth determined the range of tasks to be solved in the conduct of organic agriculture. The authors have highlighted the features of its management in Siberia and the principles on which the organizational and economic mechanism of organic production should be based. Unlike other researchers, it is proposed to use a cognitive approach to increase the demand for organic products. Given the identified features of organic production in Siberia, we have proposed directions and measures to develop the production of organic products.

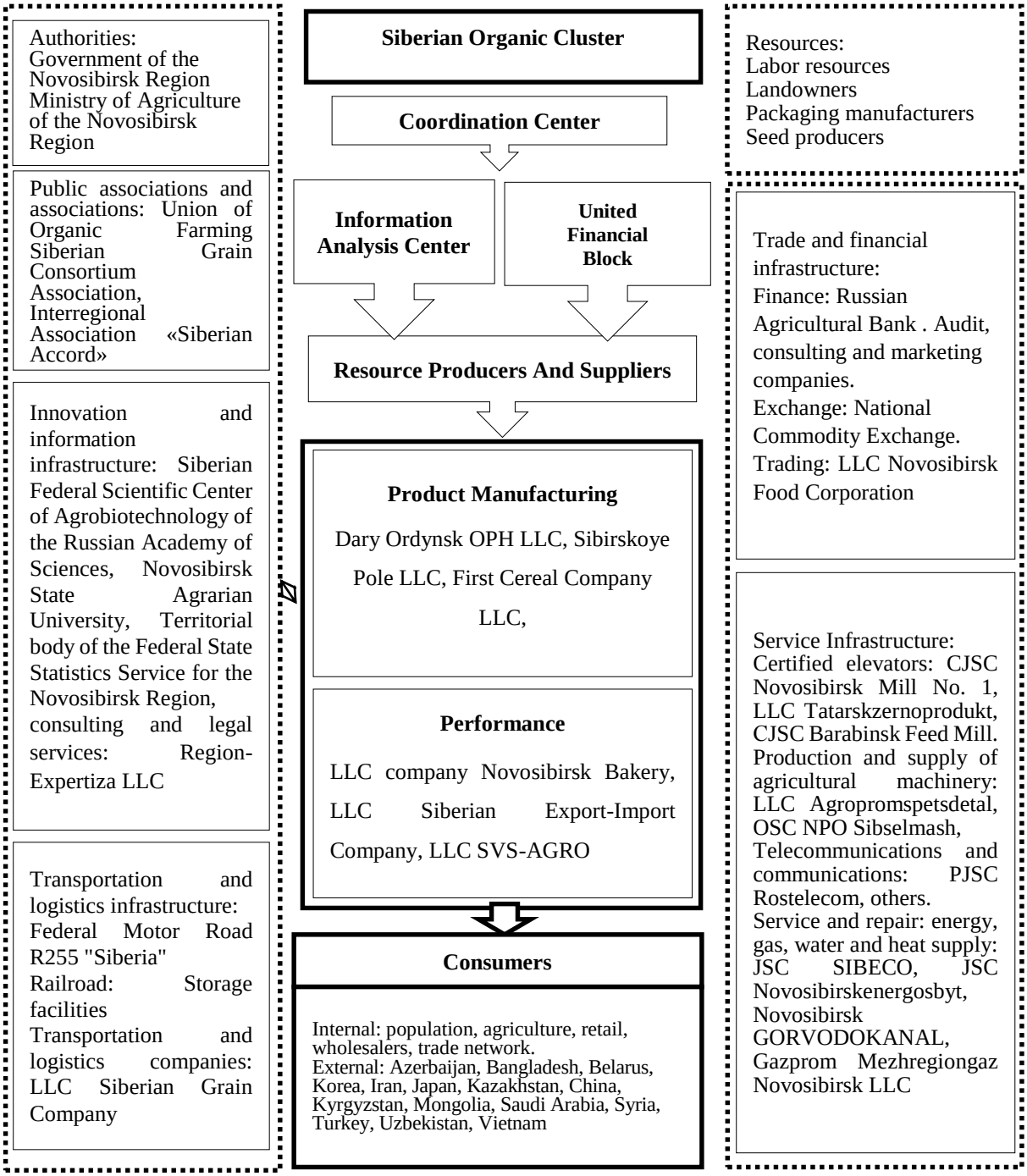

Fig. 3. The model of the "Siberian cluster producing organic crop production" on the example of the Novosibirsk region (complited by authors).

The successful development of organic production can be achieved through the integrated use of theories - concepts of innovative development and cluster mechanism. Integration of subjects based on a cluster provides

the concentration of financial, technological, innovative, and labor resources that contribute to economic growth and consist in the growth of market power, rational use of material and technical base, the presence of common infrastructure, the ability to manage risks, reduced uncertainty and better awareness. The development of organic production in the Altai Territory is facilitated by large areas of agricultural land, skilled labor, and a high environmental rating and sales market (sanatorium-resort areas, rural tourism). There are 4 certified organizations in the region: FROMWILD LLC (Biysk district) – production of wild plants (processing of pine nuts); Stepnoy LLC, 4.8 thousand hectares (Biysk district) – production of cereals and legumes); Kurai Agro Plus LLC – production of cereals; Itkul Distillery LLC – production of organic vodka of the ZernaSevera brand (Kundius 2023). According to experts, the Russian organic market may reach 250 billion rubles by 2030, increasing the share of supplies to the world market to 10%. Currently, 15 companies export products from Russia.

The main markets for organic products are geographically remote. This constrains the inflow of investments. Scientists from the Siberian Federal Scientific Center for Agrobiotechnology and the Institute of Cytology and Genetics of the Siberian Branch of the Russian Academy of Sciences should be involved in developing production. To create a center for the provision of consulting services on the platform of the Interregional Association "Siberian Agreement".

CONCLUSION

The production of organic products is a new direction in Siberia. However, it has prospects for development due to the formed resources and vast areas of uncultivated land with low doses of mineral fertilizers. In the first stages of developing a new business line, state support should be provided to compensate for certification and agrotechnological work costs. In addition to the socio-economic effect, producing organic crop products has a positive environmental effect, contributing to the preservation of the ecosystem. The main factors limiting the development of organic products in the domestic market are economic, informational, and cognitive. Overcoming the crisis phenomenon, increasing the population's income, and increasing awareness of organic products will expand domestic consumption of organic products. In the future, it is possible to create a full-fledged system of production, processing, and consumption of organic products both for the domestic market and for export. The measures and directions proposed by the authors can ensure the efficiency of organic production. The organization of the production of organic crop products is considered a knowledge-intensive industry and involves research support. In this regard, it is important to study the achievements of modern science and practice and implement these achievements by attracting and training world-class specialists.

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