On the Issue of Food Security of Coal Mining Region

Piotr Kosinskiy[1], *Natalia* Zaruba[1], *Natalia* Egorova[1], *Aleksey* Kharitonov[1]

[1]T.F. Gorbachev Kuzbass State Technical University, 28 Vesennyaya, Kemerovo, 650000

Abstract. The problems of food security of Kemerovo region are studied in the article. It was found that agribusiness and its performance are significantly affected by the pronounced industry orientation of the region, in which coal mining is intensively developed, which is accompanied by the annual land retirement. Assessing the food security of the region in terms of balanced nutrition in terms of calories, protein, fats and carbohydrates in food, one could conclude that they are not consistent with the vital needs of people. The imbalance of nutrition of the population affects its health, which, according to epidemiologists, is commensurate with genetic, active chemical or infectious negative effects on humans. To address food security of the region, a forecast of food consumption by the population was developed taking into account scientifically-based nutrition standards, taking into account: the level of money income and purchasing power of the population, effective demand for agricultural products; production capacity of agricultural industry and production facilities. It is proposed to apply a synergistic approach based on the creation of an agri-food cluster.

1 Introduction

Kemerovo Region is a coal mining region dominated by coal industry, including numerous coal open-pits. In 2017, the region ranks third in the Siberian Federal District in terms of coal production, in the amount of 241.5 million tons, 60 percent of which is accounted for by open-pit mining. Coal mining enterprises occupy large areas of land and, along with a negative impact on the environment, polluting the air and water resources, contribute to land retirement, including rock dumping on them. High-intensity coal mining in the region, the consequences of a high urban saturation are accompanied by signs of land degradation, including its fertility, a decrease in the population of animals, and therefore a loss of renewable natural resources.

Coal mining in the region is increasing annually, which entails an increase in retirement, as a rule, of highly fertile land. According to expert estimates, an average of 10 hectares of land is required to be disturbed to produce one million tons of coal by open-pit mining. In conditions of unfavorable habitat, along with other measures to ensure the normal living conditions of the population, an important factor is its balanced diet.

However, in recent years, the region does not provide itself with food from its own sources. The emphasis in the nutrition of the population is shifting towards the consumption

of bread and bread products, potatoes, which increases the content of carbohydrates in their diets and contributes to the imbalance of nutrition, which affects health.

We emphasize that the food supply and food security of the region are the main factors determining social peace in the country and its specific regions, and the guaranteed availability and affordability of food for the entire population of the country ensures an active and healthy life. Without a systematic scientific state approach to addressing the issues of food security of the population, without developing solid conceptual solutions in the field of food security, the absence of solution for this problem can lead to irreversible processes. Food security has become the most acute of many problems that have arisen during the transition of the country to the market economy, affecting every inhabitant.

The experience of foreign countries and companies shows that there is a change in the development paradigm aimed at approaching food security. In some countries, urban food strategies were developed to create a healthy and prosperous community through the reengineering of a regional food and agricultural system. For example, in Canada, urban food strategies are developed by interdisciplinary teams, local governments, nonprofit organizations, and universities to provide a wide range of food and rural planning. In such teams there are farm logistics expert, farmers, retailers, and even site creators [2, 12].

2 Materials and Methods

The level of food security is directly dependent on the development of the agricultural industry. In the conditions of budgetary shortfall, the development of the agricultural sector can be promoted by a steady attraction of investments in food production, the development of interregional cooperation of integration ties. Food self-sufficiency is the basis of food security, which determines the degree of dependence on external food supplies. The agricultural activities, its production and economic performance are influenced by exchange processes in the external environment, represented by participants in foreign and domestic markets and including material, energy, labor, information and other resources.

Trends in the development of agriculture in the region indicate high prices for resources and the disparity between prices for industrial and agricultural products. It is the prices of resources that currently determine the competitiveness of agriculture, and entry into WTO can disrupt metabolic processes and, as a consequence, lead to the loss of stability of agriculture functioning [6, 7, 10].

Food provision of the population is an economic relationship in society that arises when members of society are provided with food that meets scientifically-based standards. It is entrusted to the state, which is obliged to create conditions that guarantee the stable and efficient use of food stocks.

Food security in the region should be considered as a multidimensional phenomenon, characterized by a combination of economic, social and political aspects. Food provision is characterized by several forms of food consumption, which depend on the average daily intake of an individual: the extreme forms of food providing problem are *chronic hunger*; problems arising from drought, flooding and other unforeseen events cause *epidemic hunger*; problems caused by non-compliance of food consumed with scientifically-based nutritional standards, including the caloric content of food [3, 8, 11].

The problem of food supply of the population is especially acute in the regions with intensive development of coal mining and metallurgical industries, whose enterprises are located in rural areas. This circumstance entails not only land retirement, but their disturbance in the areas bordering on industrial enterprises, as well as the outflow of highly professional specialists from agricultural enterprises. At the same time, agriculture is the main source of food supply in the region.

Kemerovo region is a region of this type. Agricultural land as of 01.01.2018, occupies 27.3 percent in the land structure; industry, transport, communications and other special purpose industries account for 1.7 percent; forest land - 55.9 percent; settlements occupy 4.1 percent; protected areas and objects - 8.5 percent. The region is characterized by a high population density of 28.39 people per square kilometer. In the Siberian Federal District this rate is 3.75, in Russia - 8.56.

The agri-business and its performance is significantly affected by the pronounced industrial orientation of the region, in which coal mining is intensively developed, which is accompanied by the annual land retirement. As of 01.01.2018, the coal enterprises employed 79.1 thousand hectares, which are irretrievably retired

Agriculture in the region occupies a small share in GRP, which varies from 2.8 percent to 4.4 percent in recent years. This is due to the fact that the region's economy has an industrial orientation. In 2017, the volume of agricultural production, including agricultural companies, individual entrepreneurs and households increased by 2013 to 31.8 percent and amounted to 58.5 billion rubles in current prices. The technical equipment of agriculture in the region remains wanting. In 2013-2017, the tractor fleet decreased by 19.4 percent (by 386 units), combine - by 21.4 percent (by 111 units). Agricultural enterprises write off annually 5-20 percent of agricultural machinery.

As a result, the load on the tractor and combine fleet increases. For example, in 2017 there were 468 hectares of arable land per tractor, which is 75 hectares more than in 2013 per tractor; the load on the grain harvester increased by 24 hectares over the same period. This fact entails a violation of agrotechnical terms of cultivation of agricultural crops, which increases the already high risk for the agricultural sector.

We emphasize that the share of the economically active population of the region employed in agriculture in 2017 was 32.9 thousand people (2.7 percent). The forecast of food security through 2020, calculated on the basis of rational consumption standards, predicts the following volumes of production will be reached: bread and bread products - 277 thousand tons, meat and meat products - 198 thousand tons, milk and dairy products - 898 thousand tons, 687 million eggs, vegetables and potatoes are 370 and 264 thousand tons, respectively [4].

The basis of the forecast of consumption of food by the population is based on factors related to: the level of monetary incomes and purchasing power of the population, effective demand for agricultural products; production capacity of agricultural industry and processing capacity in the region; dynamics of prices for agricultural products, assortment and availability of substitute products in the regional market.

In 2017, the consumption of bread and bread products, potatoes by the population of the region was 9.3 and 10 percent more than rational consumption rates. The population, to a large extent, is under-consuming milk, vegetables, fruits and berries (46.4, 46.1, 42.1 percent, respectively), which indicates an imbalance in nutrition. The shortage of food is compensated by supplies from the regions of the Siberian Federal District and neighboring countries (Azerbaijan, Belarus, Kazakhstan).

Assessing the food security of the region in terms of balanced diet in terms of calories, protein, fats and carbohydrates in food, it can be noted that they do not correspond to the vital needs of people. Energy and food requirements depend on how hard the person performs, on his gender and age. It is required to consume 96-108 grams of proteins; 406-440 grams of carbohydrate per day for men at the mature age of 10-60 years. According to statistics for 2017, the protein content in the diet of the population in Kemerovo region was lower by 19.4-31.4, carbohydrates by 86.4-120.4 grams than acceptable daily intake.

The imbalance of nutrition of the population affects its health. According to international statistics, the dependence of birth rate and mortality of the population on health service is 10 percent, and 50 percent is the quality of food, housing conditions,

employment. Epidemiologists claim that a negative effect of insufficient and unbalanced nutrition on a person is commensurate with genetic, active chemical or infectious effects.

Modern state policy towards the agricultural sector, which provides the population with food, is focused on its sustainable development, which is its most important task. This is determined by the following: a) the mission of providing the population with food is entrusted to the agricultural sector; b) as a result of institutional changes in recent decades, the development of agriculture had negative trends; d) the state policy towards agriculture and the peasantry is implemented according to the residual principle. This circumstance does not contribute to the stable development of the agricultural sector at the regional level.

Many agricultural enterprises operate in the conditions of limited access to the food market and outlets. Due to the low financial security of agricultural enterprises and their low investment attractiveness, an economic recession is observed [1; 2]. In addition, there are problems associated with management, personnel and financial support of the agricultural business entities, the inertia of development, affecting the competitive properties of agricultural products, which is reflected in poor economic performance and failure to quickly respond to the constantly changing market environment.

The unfavorable macroeconomic situation predetermined the disparity between the profitability of agriculture and the profitability of other sectors, which impede the agricultural reproduction on a simple scale. The minimum level of profitability must correspond to 25-27 percent in order that agriculture could develop as a system.

3 Results

Since agriculture is an unstable system, it cannot self-develop without external influence. This circumstance requires the search for such approaches that can contribute to take the agricultural sector to a qualitatively new level of management and the creation of conditions for mutually beneficial interconnections of all agribusiness enterprises that meet the conditions imposed by the market.

In our opinion, this task can be solved within the framework of the agri-food cluster, as an organizational and economic mechanism that can actually contribute to the growth of agricultural production, improve the living standards of rural residents and conserve the environment for the generations to come. The feasibility of creating agro-industrial integrated formations at the present stage is due to the increase in competitive advantages and the synergistic effect of uniting parastatal business entities and including scientific and technical institutions and technology parks based on cooperation.

The emergence of a synergistic effect is due to the coordinated interaction of heterogeneous processes, which can be the initiator of a specific synergistic effect in specific conditions, which will allow the system to make the transition to a whole new level of development.

It is appropriate to use a synergistic approach to agriculture, which have the attributes of open, artificial, unstable economic system, depending on the impact of internal and external factors on it in the form of import pressure and climatic conditions.

We emphasize that the agricultural sector, as an economic system, is inherent: integrity and a single socio-economic territorial structure, within which economic actors are interconnected and interact in the process of production, distribution, exchange and consumption.

A distinctive feature of the regional agri-food cluster is: combining the efforts of participants in the food market, which will improve the competitiveness of the structure, reduce risks in the process of redistribution of commodity flows, and more quickly adapt to changes in market conditions and policies for providing the population with food.

Here you can see the general properties characterizing the cluster and synergistic approaches. This conclusion is supported by A.S. Khukhrin, who proved the similar properties of cluster and synergetic approaches in his research. These similarities have system problems at the macroeconomic level, do not affect specific enterprises, and therefore the network formed by them and within which there are interactions and interconnections, is to be studied.

According to synergetic, open and, to a certain extent, non-equilibrium systems are characterized by development through increasing their complexity and orderliness. One development cycle of a system simultaneously combines two phases: a period of smooth and predictable linear change during evolutionary development, which can later lead a system to the unstable state; the system acquires a stable state as a result of a surge that instantly takes it out of the crisis.

The synergetic approach to the stable development of agriculture is based on the fact that the activities of cluster members are carried out in an interconnected and mutually beneficial manner. The synergistic effect was calculated using the data of state statistical reporting forms of Kemerovo region business entities. In relation to the cluster, the synergistic approach is expressed in gaining the ultimate profit by its participants, taking minor management actions, which is a rather attractive side of the formation of such self-organizing economic structure as an agri-food cluster.

Based on the existing factors, a methodical approach to the interaction of entities within the agri-food cluster, based on a synergistic effect, is proposed. Produced value added and financial synergy obtained by participants in the agri-food cluster form a synergistic effect.

Saving on the scale (cost reduction due to increased production volumes, manifested by a decrease in fixed costs in their total volume); savings in diversity (coverage) when existing fixed assets are used in the production, raw materials and materials, allowing expanding the range of produced goods, will form value added.

The criteria for the feasibility of creating an agri-food cluster are: synergistic effect, higher competitiveness of cluster entities, processing and sale of food products without intermediaries, expanding the market segment, which will provide the population with food according to scientifically-based nutrition standards [4, 5] (Table 1).

Table 1. Calculation of the synergistic effect of the region's agri-food cluster, million rubles

Indicator	**Years**					
	2015	2016	2017	2018	2019	2020
Profit	12319	14561	17211	20343	24046	28422
Current period production costs	14402	14114	13691	12869	12226	11981
Estimated risk	521,1	615,9	728	860,5	1017	1202
Synergistic effect	403.4	4380.09	4777.04	5362.57	6046.6	6824

Calculations show that by 2020, the estimated profit will reach 28.5 billion rubles, 2.3 times higher than in 2015 due to a 16.8 percent decrease in production costs of the current period. The synergistic effect will be 6824 million rubles.

Thus, the proposed methodological approach to the calculation of the synergistic effect gives grounds to consider the agri-food cluster as a promising structure in the region that will combine the interests of agricultural producers, processors and consumers of food products. The feasibility of applying a synergistic approach to the development of agriculture in the region and food security is that the agrifood cluster is a self-organizing integration form that will lead to the intensification of the formation and development of

sectoral clusters. When forming a cluster, one should make choices in elaborating a development strategy, coordinating development goals and objectives adequately to industry performance, and in accordance with the strategic goal.

An important circumstance is the state food policy in support of the development of domestic agriculture. Food policy of the state should be implemented using benchmarking, as the most effective method of extrapolating the experience of foreign countries.

It is more important for the state to support the concentration of food production, which consists in concentrating all stages of production and sales cycles, which will have a significant impact on reducing production costs and the cost of food, and as a result, increase food affordability for the population. Such a concentration can be carried out only within the framework of the agri-food cluster.

4 Conclusion

Summarizing the above, we can conclude that the formation of food security at the regional level is a multifactorial system, including: affordability and physical access of the population to safe and nutritious food of its own production in accordance with scientifically-based consumption standards; the resistance of the economic system against the internal and external impacts of economic, political nature and the ability of the system to withstand and minimize the costs associated with the negative effects on the system that have occurred; taling agriculture, as the main supplier of food, to a qualitatively new level of management that will ensure food security in the region.

To ensure the food security of coal mining region, it is proposed to apply a synergistic approach based on creating an agri-food cluster, whose activities will ensure optimal mutually beneficial interconnections of all participants, obtaining a synergistic effect, affecting not only the economic activities of its participants, but also the functioning of other clusters.

References

1. A.D. Sheingate, *The rise of the agricultural welfare state. Institutions and interest group power in the United States, France, and Japan* (Princeton University Press, Princeton, 2001)
2. *Agricultural Policies in OECD Countries. Monitoring and evaluation 2007* (OECD, Paris, 2007)
3. D. John Shaw, *Global Food and Agricultural Institutions* (Taylor & Finance group, Routledge, 2009)
4. E.A. Fedulova, A.V. Medvedev, P.D. Kosinskiy, S.A. Kononova, P.N. Pobedash, Foods and Raw Materials, **4:2**,157 (2016)
5. E.A. Fedulova, A.V. Medvedev, P.D. Kosinskiy, S.A. Kononova, P.N. Pobedash, Foods and Raw Materials, **4:1** (2016)
6. O. Flaten, S. Hisano, Nougyou to Keizai Agriculture and Economy, **73:8**, 129 (2017)
7. D. Giovannucci, S. J. Scherr, D. Nierenberg, C. Hebebrand, J. Shapiro, J. Milder, K. Wheeler, *Food and Agriculture: The Future of Sustainability* (Taylor & Finance group, Routledge, 2012)
8. H. Joseph Hülse, *Science. Agriculture, and Food Security* (NRC Research Press, Ottawa, 1995)
9. T. Jurzina, N. Egorova, N. Zaruba, P. Kosinskiy, E3S Web Conf., **21**, 04010 (2017)

10. M. Cellura, F. Ardente, S. Longo, Journal of Environmental Management, **93:1**, 194 (2012)
11. L.J. Van der Meer Cornelis, *Japanese Agriculture. A comparative economic analysis* (Taylor & Finance group, Routledge, 1990)
12. Allen Patricia, *Torether at the table.Sustainability and Sustenance in the American Agrifood System* (The Pennsylvania State University Press, Providence, 2004)