

# CLUSTER TRANSFORMATION OF THE REGIONAL AGRO-INDUSTRIAL COMPLEX AS AN IMPORTANT CONDITION FOR MOBILIZING THE GENETIC RESOURCES OF PLANTS AND ANIMALS

<sup>a</sup>I. L. BEILIN, <sup>b</sup>M. SH. TAGIROV, <sup>c</sup>F. F. ZINNATOVA

<sup>a,c</sup> Kazan Federal University, Institute of Management, Economics and Finance, 8 Kremlyovskaya street Kazan 420008, Russia

<sup>b</sup> Tatar Scientific Research Institute of Agriculture, FRC Kazan Scientific Center, Russian Academy of Sciences, 420111, Kazan, Bauman St. 20, Russia

email: <sup>a</sup>i.beilin@rambler.ru, <sup>b</sup>info@prescopus.com

<sup>c</sup>info@ores.su

**Abstract.** The article presents the approaches of linear programming in the cluster transformation of the regional agro-industrial complex in the context of the need to mobilize the genetic resources of plants and animals. This study is aimed at solving the problems of increasing agricultural productivity as a result of synergistic effects from the implementation of science-intensive projects to mobilize the genetic resources of plants and animals, which is possible with territorial and sectoral integration. In the context of the transformation of economic relations, the development of integration processes in the agro-industrial complex has acquired strategic importance, which is due to the need to stabilize the economic situation of agricultural formations, restore damaged industrial and economic ties, and observe the parity of interests of all sectors and economic entities. Processing enterprises also seek to secure stable incomes, thanks to the availability of a reliable raw material base or markets for products.

**Keywords:** approaches of linear programming, cluster transformation of the regional agro-industrial complex, increasing agricultural productivity

## 1 Introduction

The most widespread in practice are integrated agricultural enterprises in the form of a simple partnership, joint-stock company, association, union, consumer cooperative, holding company. The choice of one form or another depends on the economic situation in the region, the state of the food market, forms of capital pooling, participation in management, and decisions of administrative bodies. Regardless of the chosen form for all integrated agro-industrial formations, the combination of all links (from production to processing and sale) and the combination of interests of agricultural producers and processing enterprises remains characteristic. (Sumner, et al 2010; Enright et al 2003; Beilin, 2016).

When carrying out joint activities without forming a legal entity, participants in an agro-industrial association conclude an agreement on the formation of a simple partnership (agreement on joint activity). This makes it possible to improve the economic conditions for the activities of counterparties, as certain tax privileges apply to simple partnerships. In addition, the agreement allows us to solve the tasks to increase production, improve its quality, competitiveness, creates all conditions for each enterprise to fulfill its responsibilities. (Ostergaard & Park, 2015; Hufbauer et al 2008; Igor & Beilin, 2018; Khmeleva et al 2015; Kling, et al 2010).

The most common organizational and economic form of agro-industrial integration is a joint-stock company, where the formation of relationships between agricultural producers and processing enterprises is carried out on a contractual basis, with each participant retaining all the rights and obligations of a legal entity. A more complex agro-industrial formation is a holding company. In it, the integration process is initiated not by agricultural producers, but by processing enterprises. The creation of holding-type associations is possible and appropriate if, along with insolvent enterprises, a financially sound organization is a potential participant in the association. It should not only have the necessary financial resources to fulfill the role of the parent company, but also have economic and other interests that can best be realized in this role (Khmeleva & Bulavko, 2016; Zadeh, 2002; Lichtenberg et al 2010; BEILIN & KHOMENKO, 2018; Unnevehr, et al 2010).

## 2 Methods

Any linear programming problem, regardless of the type of record, can be reduced to standard and canonical form and solved

by the simplex method, which in a sense is a universal linear programming method. The simplex method algorithm is iterative in nature. The algorithm for solving the linear programming problem by the tabular simplex method consists of the following steps:

1. Calculate and fill in the initial simplex table with a valid unit basis, including the index row;
2. Find the resolving column;
3. Find the permission line;
4. Calculate all parameters of the matrix by the Jordan-Gauss method;
5. Analyze the received data in the index row.

The tables of the simplex method must be built until an optimal plan is obtained. The plan will be considered optimal if there are only zeros and positive numbers in the last index row of the simplex table. When constructing the simplex method, it was assumed that all the support plans are non-degenerate, which ensured that the optimal plan was obtained in a finite number of steps. In the case of a degenerate plan, the calculations are carried out similarly, but in this case, a return to the old basis is possible, which leads to the so-called looping.

## 3 Results And Discussion

The most preferred for agricultural producers in the conditions of mobilization of the genetic resources of plants and animals are cooperative formations, since they most fully reflect their interests. As founders or members of a cooperative, they receive the right to process their products on the terms set by themselves, based on available opportunities, independently manage the income received, avoiding additional taxation. The regulation of economic relations within a cooperative and with other organizations is achieved in various ways, including through treaties and agreements on mutually beneficial cooperation.

A new direction in the integration of activities to mobilize the genetic resources of plants and animals is the creation of financial and industrial groups. However, this process is very slow and, above all, because there are serious restrictions on their formation and activities: participation of enterprises and organizations in more than one group is not allowed; Mandatory joining the financial and industrial group of supply and marketing organizations, banks or other credit institutions; Subsidiaries and enterprises may be part of the financial and industrial group only together with their main company (Fig. 1).

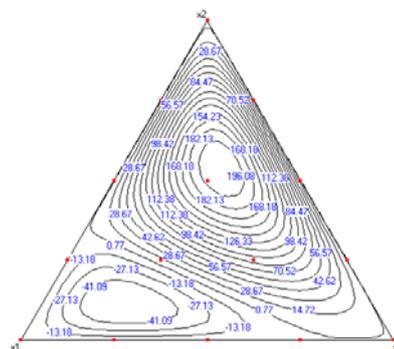


Figure 1. Simplex optimization of the limitations of the formation and activities of financial and industrial groups for the mobilization of genetic resources of plants and animals

An analysis of the various options for interaction between regional agricultural enterprises allows us to conclude that no form has an absolute advantage over others, so the development of integrated structures in accordance with regional characteristics

is logical. In this regard, five main directions of normalizing the economic conditions for the creation and functioning of agro-industrial associations to mobilize the genetic resources of plants and animals can be identified:

Institutional change;

Mutual economic support for integration participants;

Organization of partnership economic relations;

Revival and adaptation to modern conditions of the system of internal production calculation;

Organizational, economic and legal assistance of the state and all interested non-state structures

The mechanisms for the practical implementation of these directions of mobilizing the genetic resources of plants and animals can be put into effect both in the organization of new agro-industrial associations and in previously created integrated structures (Fig. 2).

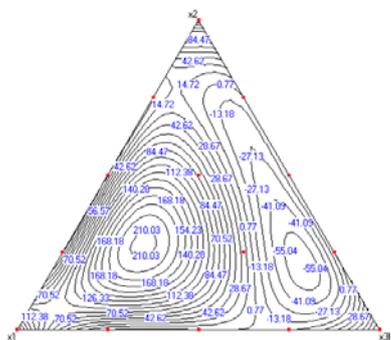


Figure 2. Simplex optimization of the normalization of the conditions for the creation and functioning of agro-industrial associations to mobilize the genetic resources of plants and animals

In the framework of this study, a methodology has been developed for clustering commodity producers in the field of mobilizing plant and animal genetic resources for the agricultural efficiency of the region, which is a set of logically structured optimization models. Structurally, the technique consists of two blocks. The first block is the modeling of indicators reflecting the effectiveness of agriculture in all categories of farms in the region:

A model of the growth rate of agricultural products depending on the growth rates of crop and livestock production;

A model of the growth rate of crop production, depending on the growth rate of the yield of cereals, potatoes and vegetables;

Livestock production growth rate model depending on the growth rate of the average annual milk yield in agricultural enterprises (per cow) and the volume of livestock and poultry meat production

The second block is the modeling of indicators characterizing the effectiveness of the agricultural sector in the context of agricultural enterprises of various organizational and legal forms and taking into account the scale of activity:

Cereal and soybean production models;

Milk and meat production models;

Models of revenue from sales of agricultural products

The study of a set of indicators for assessing structural changes (based on economic and mathematical models) makes it possible to determine the degree of change in the benefits or threats in the agricultural structures of the economy. The results of this

assessment can be used to optimize the agricultural structure in order to create new competitive advantages of agricultural products, agricultural producers rural areas (Fig. 3).

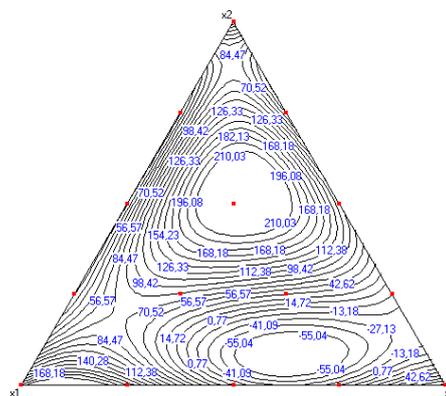


Figure 3. The study of a set of indicators to assess the structural changes in the cluster transformation of the regional agro-industrial complex in the conditions of mobilization of the genetic resources of plants and animals

Cluster organization in the field of mobilization of plant and animal genetic resources and their use in order to increase the competitiveness of the regional economy is currently insufficiently studied. Meanwhile, the formation and functioning of agro-industrial clusters will create favorable conditions for the innovative development of regional food systems. Clusters enable regional authorities to implement a strategy for the socio-economic development of the region in the direction of ensuring the competitive advantages of the regional economy, introducing innovations the territorial economic system. In the concept of the development of agrarian clusters, based on a system-synergetic approach, an agrarian cluster is defined as a system of interconnected forms of organizing activities that are integrated with the goal of simultaneously and solving environmental problems and introducing innovative technologies into production that turn “waste” into rural development resources farms. Thus, it is emphasized that the formation of clusters is based on the use of innovative technologies that generate a certain division of labor; clustering will help transform agriculture into a high-tech, industrialized, energy-producing, self-sufficient, diversified industry; at the same time, there will be a significant decrease in the energy intensity of gross agricultural output and the country's GDP as a whole and a significant increase in food exports.

#### 4 Summary

Despite the obvious, proven by world practice, advantages of the cluster approach, its use in Russia is limited due to the presence of a number of problems. In the field of mobilizing the genetic resources of plants and animals, this is the lack of relevant practical experience, the necessary staff and the low level of development of the agricultural sector in most regions of the country. The advantages of the cluster approach are that it really gives high importance to the microeconomic component and takes into account the territorial and social specifics. As a result, the implementation of this approach, stimulating the effective development of the region, increases the competitiveness of its production systems, products, increases employment, budget revenues and the competitiveness of the regional economy as a whole.

#### 5 Conclusions

In the field of mobilizing the genetic resources of plants and animals, two types of clusters can be distinguished: those initiated “from above” and “from below”. The “top” initiative means that the state decides to create clusters based on the complex mathematical model of development that has been built, and “bottom” means that cluster programs are initiated by the local

business community. Some researchers are of the opinion that in Russia it makes no sense to build clusters "from above": because of the low share of added value of small enterprises and their small number, developed spatial clusters are out of the question. The artificial creation of clusters using mathematical methods will lead to the selection of existing industrial complexes. Therefore, it is necessary to focus on the formation of regional clusters in new industries that have developed in recent years, such as the mobilization of plant and animal genetic resources. The combined approach to the development of regional agrarian clusters in agriculture under Russian conditions is determined by the fundamental features of agricultural production. This is its capital intensity and low capital productivity, a long payback period (from investing to receiving products in crop production takes 10-12 months, in livestock production - two years or more), dependence on natural processes, natural and climatic conditions, low elastic demand food, the need for state intervention.

### Acknowledgements

The work is performed according to the Russian Government Program of Competitive Growth of Kazan Federal University.

The article was prepared based on the results of research conducted within the framework of the state task under the leadership of the Federal Agency of Scientific Organizations of Russia, with the registration number: AAAA-A18-118031390148-1.

### Literature

1. Beilin I. L., Khomenko V. V., Selivanova K. M.: Directions for the development of the oil and gas chemical complex as the Main sector of the economy in the region. *Ad ALTA: Journal of interdisciplinary research*. 2018. 70-73 p.
2. Beilin il, khomenko vv.: management of an innovative project in the polymer industry of the region under the conditions of an investment crisis. *revista publicando*, 5 no 16. (2). 2018, 407-414. Issn 1390-9304.
3. Catherine L. Kling, Kathleen Segerson and Jason F. Shogren.: "Environmental Economics: How Agricultural Economists Helped Advance the Field" *American Journal of Agricultural Economics*, v. 92, 2010. 487-505. P.
4. Daniel A. Sumner, Julian M. Alson, and Joseph W. Glauber,:
5. "Evolution of the Economics of Agricultural Policy", *American Journal of Agricultural Economics*, v. 92, 2010. 403-423.p
6. Enright M.J. Brocker J., Dohse D., Soltwedel R. (Eds.): *Regional clusters: What we know and what we.: should know*. In: *Innovation Clusters and Interregional Competition: in 2 parts*. Berlin: Springer, Part 2. 2003, 99-129. p
7. Hufbauer G.C., Schott J.S., Elliott K.A., Oegg B.: *Economic Sanctions Reconsidered*. Third edition. Peterson Institute For International Economics. Washington DC, 2008. 233 p.
8. Igor L. Beilin, Vadim V.: Khomenko Management of innovations in the petrochemical sector on the basis of economic and mathematical modeling methods. *IIOAB Journal*. Vol. 9, ISSUE (S2), 2018.: *Multidisciplinary Social Science & Management*. 30-35. p.
9. Lichtenberg E, Shortle J, Wilen J and Zilberman D.: "Natural Resource Economics and Conservation: Contributions of Agricultural Economics and Agricultural Economists" *American Journal of Agricultural Economics*, v. 92, 2010, 469-486.p.
10. Khmeleva G.A., Orlova L.V., Bulavko O.A., Kostromin K.O., Umerbaeva S.K.: Identification of Perspective Transborder Clusters of Russia and Kazakhstan. *Mediterranean Journal of Social Sciences*, vol 6 (4), 2015, 302-312.p DOI:10.5901/mjss.2015.v6n4s2p302.
11. Khmeleva G.A., Bulavko O.A.: From the 2008 to the 2014 crisis: response of the labor market of Russia's largest cities. *International Journal of Environmental and Science Education*, vol. 11 (10), 2016, 3791-3806. P.
12. Ostergaard C.R., Park E.: What Makes Clusters Decline? A Study on Disruption and Evolution of a High-Tech Cluster in Denmark. *Regional Studies*, vol. 49 (5), 2015, 834-849. p DOI: 10.1080/00343404.2015.10159756.
13. Unnevehr L, Eales L, Jensen H, Lusk J, McCluskey J, and Kinsey J.: "Food and Consumer Economics" *American Journal of Agricultural Economics*, v. 92, 2010. 506-521. p
14. Zadeh L.: Toward a perception-based theory of probabilistic reasoning with imprecise probabilities. *Journal of Statistical Planning and Inference* 105, 2002, 233-264 p.

**Primary Paper Section: G**

**Secondary Paper Section: GA, GC, GE**