Development of Integration Processes in the Agro-Industrial Complex of the Russian Regions

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Abstract:

This paper is devoted on the methodology for assessing the development of extra- and intra-integration structures. This methodology consists of three levels of economic assessment of the agro-industrial sector: the regional level, the economic sector level, and the enterprise level. The agro-industrial complex of the Altai Republic has positive business dynamics due to the development of the livestock industry. Through assessing the business outlook for agro-industrial integration using the three levels, it has been determined that the livestock industry has the greatest potential for creating large integrated structures in the Altai Republic.

The study justifies the need for creating an internal cluster (intra-cluster) in the maral deer breeding sphere of the Altai Republic, and an external cluster (extra-cluster) in the sphere of meat-and-dairy cattle breeding in the Altai Republic and the Altai Territory. The authors propose a 'business-as-usual' and a target scenario for the development of the agro-industrial complex of the Altai Republic until 2025.

The target scenario reflects the effectiveness of the proposed measures for the development of the agro-industrial complex of the Altai Republic. According to this scenario, the formation of intra-clusters and extra-clusters in 2025 will lead to an increase in total profits of the livestock industry enterprises under analysis by 451 million rubles and of budget allocations by 194.3 million rubles. The goal of this study is to develop theoretical and methodological guidelines for shaping and developing integrated structures in the agro-industrial complex.

Keywords*: Integrated structures, business-as-usual and target predictive scenario, organizational models*

JEL Classification*: Q10; L60; R10; O18; F15.*

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1. Introduction

At the present stage, the country's economy is facing one of its main goals - ensuring the state's food security. Achieving this goal involves solving two main tasks: firstly, the country needs a transition to an innovation-based development, and, secondly, the country needs a rapid promotion of substituting imports in the food sector (Akhmetshin *et al.,* 2018a). The solution of these tasks is possible through the formation and development of integration structures in the local Agro-industrial Complex (AIC). Agro-industrial integration through the mobilization of raw materials and the technological potential of the areas can significantly enhance the competitiveness of the agro-industrial sector, and, as a result, have a positive impact on the macroeconomic indicators of national development (Gritsenko and Borisova, 2014).

2. Methodology

Analysis of the works of Russian domestic economists and agrarians has shown that agro-industrial integration is an association of enterprises in the industrial chain of the agri-food market, which consists of the manufacture of agricultural raw materials, processing, food production, and trade, and which interacts according through the consolidation of the economic interests and goals of all participants in the integration processes (Vasilyev, 2016; Vasiliev, 2014; Winslav, 1998; Rasskazova *et al.,* 2014; Voronkova *et al.,* 2018; Sycheva *et al.,* 2018; Gamede and Uleanya, 2018).

The specific nature of integration in the agro-industrial complex, which determines its feasibility, arises from the discriminatory position of the second and third areas of the agro-industrial complex, especially the agricultural sector in the structure of the exchange processes of the present national agri-food market. This key feature is conditioned by the type of market structure (pure competition) and the low influence on the equivalence of exchange processes in product sales, as well as in the procurement of material and technical resources (Shchetinina, 2013; Sadriev *et al.,* 2016). As a result of a comparative analysis, we concluded that in current economic conditions the most promising form of integration structure contributing to the sustainable development of the agro-industrial complex is the agro-industrial cluster (Vinnikov, 2016).

3. Discussions

According to Porter, "clusters are geographically concentrated groups of interconnected companies, specialized suppliers, service providers, firms in relevant industries, and organizations related to their activities" (Porter, 1993). Many countries have accumulated extensive experience in exercising the cluster approach in economic policy aimed at the economic growth of a number of industries and regions (Roeland, 1999; Feser, 2003; Aleksandrova *et al.,* 2014). Increasing

competitiveness through cluster development at present is proposed by V. Feldman who understands a cluster as a diversified set of industries interacting on the basis of supplies and acquisitions based on the input-output model (Feldman and Audretsch, 1999; Smirnova and Rudenko, 2016).

The cluster approach to the study of competitive economic processes is considered by a number of other scientists (Akhmetshin *et al.,* 2017a; 2017b). In the analysis of foreign trade, Leamer highlights national clusters with a significant degree of correlation exports (Leamer, 1984). Tolenado (1978) and Soulie (1989) designate a cluster as an "industry" or an interdependence of economic sectors at a technological level based on the need for technological interactions of various industries and economic sectors to provide a competitive. Cluster forms of organization are found in Germany, Japan, and in the developing countries of Latin America, Asia, and Africa. The cluster organization of production is assessed by economists as the leading one for developing countries (Brown, 2000; Akhmetshin *et al.,* 2018b).

A cluster in the agro-industrial complex is represented as a geographically separate, innovatively directed quasi-integrated structure formed on the basis of the technological chain principle and realizing common economic interests of the stakeholders connected in the structure by a certain culture of interaction (Bogdanova, 2007; Gabidullina *et al.,* 2018). We assign the agro-industrial cluster with the functions of the main instrument of goal-oriented project planning (Korableva *et al.,* 2017) and management within the framework of the agro-industrial regional policy for the integrated use of the economic and social components of the region (Glotko, 2008). However, it should be noted that clusters in the agro-industrial complex noticeably lag full-fledged industrial clusters and develop very slowly, despite their presence in the structure of industrial enterprises. Speaking of clusters in the sphere of the agro-industrial complex, we note two alternative complementary strategies: an increasing awareness in the resulting clusters; and the creation of new types of constructive interaction within a cluster structure (Metelev *et al.,* 2016).

The intra-integrational agro-industrial structures in the agro-industrial complex are referred to as an innovation-oriented system of intraregional relations between territorially concentrated business entities – agricultural producers, food and processing industries (cluster core), infrastructure, and government agencies, as well as scientific and educational institutions (Akhmetshin *et al.,* 2018c; Kaiyrbayeva *et al.,* 2018; Marliyah *et al.,* 2018). The extra-integration agro-industrial structures are represented as an innovation-oriented system of interregional relations among economic entities – agricultural producers, food and processing enterprises (cluster core), and infrastructure located in transboundary regions providing for interregional interaction between legislative and executive bodies, as well as scientific and educational institutions (Akhmetshin *et al.,* 2017c; Nagimov *et al.,* 2018; Polyakova *et al.,* 2018).

The Altai Republic is part of the Siberian Federal District located in the south of Western Siberia and is a border area. It has a common border with the Republics of Tyva and Khakassia, the Altai Territory, and the Kemerovo Region, as well as China, Mongolia, and Kazakhstan (Region Passport). Due to its climatic features and the presence of year-round distant pastures, the Altai Republic is traditionally considered as an agro-industrially orientated region. Analyzing the structure and dynamics of the GRP, it should be noted that agriculture's share in the Republic's GRP is relatively stable and averaged 4.72% over the period of 2012-2016. Overall, the agro-industrial complex accounts for about 18% of the gross output of the Altai Republic (according to 2016 data). According to the figures from 2017, the Altai Republic's population is 217 thousand people; 153.7 thousand people are residents of rural areas, which is 70.8% of the total population. In this regard, it can be asserted that agriculture is the main source of income for residents of the Republic (Passport of the Region).

In the Siberian Federal District in 2016, the proportion of the production of the main types of agricultural products from Altai Republic farms in all categories amounted to 1.71%. According to this indicator, the Altai Republic is second only to the Tyva Republic. At the same time, since 2012 there has been growth in the production of the main types of agricultural products in the Republic. Thus, in 2016 the production of agricultural products in actual prices has increased by 2,213 million rubles compared to 2012. By contrast, in terms of per capita agricultural production, the Altai Republic is among the leaders in the Siberian Federal District.

In 2016, agricultural products worth more than 54 thousand rubles were produced per capita in the region, which is 16 thousand rubles higher than the national average and 19 thousand rubles higher than the same indicator for the Siberian Federal District (On the results of the implementation of the state program of development of the agro-industrial complex of the Altai Republic in 2015). The main areas of animal husbandry in the region are traditionally dairy cattle, sheep, and beekeeping. Tracing the indicators of livestock production in the region since 2012 has revealed a tendency to reduce milk production by 3.8%, eggs by 15.79%, and honey by 38.36%. At the same time, the production of livestock and poultry in live and dead weight has increased by 14.74% and 14.65% respectively, and wool by 4.4% (Table 1).

Table 1. *Production of livestock products in farms of all categories in the Altai Republic, 2012-2016.*

Livestock Production	2012	2013	2014	2015	2016	2016 to 2012, %
Livestock and poultry in live weight, thousand tonnes	47,5	50,5	51,4	53,5	54,5	114,74%
Livestock and poultry in dead weight, thousand tonnes	27,3	29,1	29,7	30,8	31,3	114,65%
Milk, thousand tonnes	92,1	92,7	91,6	89,7	88,6	96,20%

Eggs, million pieces	13,3	12,8	12,3	11,2	11,2	84,21%
Wool (gross weight), tonnes	1114	1151	1158	1170	1163	104,40%
Honey, tonnes	876	683	637	615	540	61,64%

In order to assess the possibilities for the development of integration structures in the branches of the agro-industrial complex (rating level 2), an integration decision-making matrix has been developed that describes the integration possibilities of the branches of the regional agro-industrial complex in terms of growth and production efficiency (Table 2).

Table 2. *Matrix of decision making on the development of integration processes in the agro-industrial complex of the region*

<table>
<tr><td rowspan="2" colspan="2"></td><td colspan="2">The value of the industry localization ratio</td></tr>
<tr><td>$K_{ri} < 1$</td><td>$K_{ri} \geq 1$</td></tr>
<tr><td rowspan="4">Potential growth in industry</td><td>High</td><td>Quadrant 2: High integration opportunities (development of Financial and Agro-Industrial groups, agricultural holdings)</td><td>Quadrant 1: Absolute integration (development of agricultural parks, clusters)</td></tr>
<tr><td>Low</td><td>Quadrant 4: Extremely low integration opportunities (development of associations, unions)</td><td>Quadrant 3: Low integration opportunities (development of associations, unions)</td></tr>
</table>

The proposed methodology was tested on the materials of the Altai Republic. The following matrix was filled out based on these materials (Table 3).

Table 3. *Decision-making matrix on the development of integration processes in the agro-industrial complex of the Altai Republic*

<table>
<tr><td rowspan="2" colspan="2"></td><td colspan="2">The value of the industry coefficient localization ratio</td></tr>
<tr><td>$K_{ri} < 1$</td><td>$K_{ri} \geq 1$</td></tr>
<tr><td rowspan="2">Potential growth in industry</td><td>high</td><td>Quadrant 2: poultry husbandry ($K_{ri}=0,95$), vegetable farming ($K_{ri}=0,58$), fruit farming ($K_{ri}=0,32$).</td><td>Quadrant 1: cattle husbandry ($K_{ri}=2,87$), sheep husbandry ($K_{ri}=2,34$), maral deer husbandry ($K_{ri}=1,03$), bee-farming ($K_{ri}=1,06$).</td></tr>
<tr><td>low</td><td>Quadrant 4: pig husbandry ($K_{ri}=0,8$), rabbit husbandry ($K_{ri}=0,54$), field husbandry ($K_{ri}=0,41$), melon growing ($K_{ri}=0,21$), gardening ($K_{ri}=0,1$).</td><td>Quadrant 3: horse breeding ($K_{ri}=1,98$), grassland husbandry ($K_{ri}=1,1$).</td></tr>
</table>

The results of testing the developed methodology based on the example of the Altai Republic reveal that in the agro-industrial complex of the region, cluster development strategies are possible for implementation in the cattle breeding, sheep breeding, maral breeding and beekeeping industries (Cherepovitsyn *et al.,* 2017).

Enterprises of the poultry, vegetable and fruit growing industries have high integration capabilities (Romasheva *et al.,* 2018). The maral breeding industry has the greatest potential for creating intra-integration structures in the Altai Republic (Poltarykhin and Tarasova, 2014).

It was also revealed that from the standpoint of the development of interregional agro-industrial relations, the cooperation of the Altai Republic with the Altai Territory is most promising. We have concluded that the creation of an extracluster is most appropriate in the dairy and beef cattle industries, since these industries are characterized by the largest contribution to the gross product. In order to determine the economic result of the introduction of intra- and extra-integrated structures in the agro-industrial complex of the region (Peshkova *et al.,* 2017), we have developed an appropriate forecasting technique for predicting the development of the agro-industrial complex of the region based on the intra and extra-integration structures from of the scenario approach (Cherepovitsyn and Ilinova, 2018).

The first stage involves an assessment of the parameters of the 'business-as-usual' scenario of the development of the agro-industrial sector using the Microsoft Office Excel software package. The forecast indicators of the industries of maral breeding and cattle breeding in the Altai Republic for 2018-2025 were produced with the help of a linear prediction function:

$$y = a + bx,$$
where
$$a = \overline{y} - b\overline{x},$$
$$b = \sum(x - \overline{x})(y - \overline{y})/\sum(x - \overline{x})^2.$$

It was identified that as a result of the 'business-as-usual' development of the branches, the number of marals in the Altai Republic will have increased by 7.2% by 2025, and the number of cattle by 18.4% compared with the current level.

To compile a target scenario for the development of livestock industries in the Altai Republic involving the development of intra- and extra-integration structures (stage 2 of the proposed methodology), the effect of cost reduction in product cost as part of the expansion of operations of integrated structures was calculated (Table 4).

Table 4. *Estimated cost of product sales in the framework of expansion of operations in the Altai Republic, mln. rub. (forecast)*

Indicator	2018	2019	2020	2021	2022	2023	2024	2025
Maral deer intra-cluster								
Cost of production before the formation of the extra-cluster (forecast)	357,4	392,5	427,5	462,6	497,6	532,7	567,7	602,8

Estimated cost of production after integration	357,4	392,5	313,8	341,8	369,8	397,8	425,9	453,9
Savings due to cost reduction	0	0	78,6	85,7	92,7	99,7	106,8	113,8
Cattle husbandry extra-cluster								
Cost of production before the formation of the extra-cluster (forecast)	278,8	302,6	307,4	312,2	353,5	358,7	364,0	369,3
Estimated cost of production after integration	278,8	302,4	245,7	249,5	282,6	286,8	291,0	295,3
Savings due to cost reduction	0	0	61,6	62,5	70,8	71,9	72,9	74,0

It was revealed that the cumulative savings due to the reduction of costs in creating an internal cluster in the branch of maral deer industry for the period of 2018-2025 will amount to 577.6 million rubles. The creation of an extracluster in the meat and dairy cattle breeding industry for the Altai Republic helps to reduce the cost of production of the industry by 414 million rubles by 2025. Based on the obtained data, a forecast for the development of the agro-industrial sector industries was made subject to formation of integrated structures in the branches of the maral breeding and cattle breeding, the results of which are presented in Tables 5 and 6.

Table 5. *Target intra-cluster development scenario in the Altai Republic*

Indicators	2018	2019	2020	2021	2022	2023	2024	2025
Maral deer population, thousand head	56,2	58,6	61,2	62,5	63,9	65,2	66,6	67,9
Gross output of raw antlers, tonnes	91,8	96,3	103,2	92,5	88,9	84,6	86,2	92,3
Production of preserved antlers, tonnes	67,0	69,8	72,8	74,4	76,1	77,6	79,3	80,9
Returns from maral deer production sales, mn. rub.	708,5	806,3	905,3	990,2	1087,3	1181,4	1274,7	1369,8
Production cost, mn rub.	270,0	285,8	313,8	341,8	369,9	397,9	425,9	453,9
Deductions in the budget of the Republic, mn. rub.	127,5	145,1	163,0	178,2	195,7	212,7	229,4	246,6
Net profit from maral deer production sales, mn. rub.	210,9	275,4	328,6	345,1	361,7	371,9	399,3	401,9

Table 6. *Target extra-cluster development scenario for the Altai Republic*

Target prediction	2018	2019	2020	2021	2022	2023	2024	2025
Cattle population	269,6	273,9	357,4	367,2	376,9	386,7	396,5	406,3
Gross meat production, thousand tonnes*	33,5	34,4	44,6	45,9	47,1	48,3	49,5	50,7
Gross milk production, thousand tonnes	86,9	85,9	112,4	111,1	109,8	108,4	107,1	119,4
Returns from industry sales, mn. rub.	328,0	356,1	464,6	477,3	546,6	560,8	574,9	589,1
Cost of production, mn. rub.	222,9	241,9	245,7	249,5	282,5	286,8	291,0	295,3
Deductions in the budget of the Republic, mn. rub.	16,7	17,1	27,8	28,6	32,7	33,6	34,4	35,3
Net profit from cattle production sales, mn. rub.	26,3	28,5	54,1	54,9	58,2	61,1	62,2	65,0

4. Results

To assess the planned effect of the development of integration units in the agro-industrial complex of the Altai Republic, we will perform a comparative analysis of the scenarios for the development of clusters provided in the third stage of the methodology in this study (Table 7).

Table 7. *Comparative analysis of the 'business-as-usual' and target scenarios for the development of branches of the agro-industrial complex of the Altai Republic*

Indicators	Business-as-usual scenario		Target scenario		Deviation of target from business-as-usual scenario, 2025, %
	2025	by 2015, %	2025	2025 by 2015, %	
Intra-cluster					
Maral deer population, thousand heads	57,7	107,2%	67,9	126,2%	117,7%
Gross output of raw antlers, tonnes	69,2	78,8%	92,3	105,1%	133,4%
Production of preserved antlers, tonnes	62,2	136,7%	80,9	177,7%	130,1%
Returns from maral deer production sales, mn. rub.	1057	251,5%	1369,8	325,8%	129,6%
Production cost, mn rub.	602,8	248,9%	453,9	189,4%	74,0%
Deductions into the budget of the Republic, mn. rub.	172,4	227,7%	246,6	325,8%	105,7%

Net profit from maral deer production sales, mn. rub.	233,3	241,2%	401,9	415,0%	172,1%
Extra-cluster					
Cattle population	299,6	118,4%	406,3	160,4%	135,6%
Gross meat production, thousand tonnes*	40,3	130,9%	50,7	164,9%	125,8%
Gross milk production, thousand tonnes	79,8	89,1%	119,4	133,1%	149,6%
Returns from industry sales, mn. rub.	434,5	185,9%	589,1	252,0%	135,6%
Cost of production, mn. rub.	369,4	185,7%	295,3	148,6%	79,9%
Deductions into the budget of the Republic, mn. rub.	21,9	184,0%	35,3	296,5%	161,2%
Net profit from cattle production sales, mn. rub.	32,8	175,1%	65,0	347,6%	198,2%

The target development scenario is the most preferable for the branches of maral breeding and cattle breeding. As a result of the development of an intra-cluster, deductions to the budget of the Altai Republic in 2025 will exceed the amount of deductions in 2015 by 225%, maral deer livestock will increase by 26.2% by 2025, and profit growth will be 315%. The formation of an extra-cluster by 2025 also implies the growth of all base indicators of the industry: cattle livestock by 60.4%, profits by 247.6%, and deductions to the regional budget by 196%. Thus, the measures proposed within the framework of the development of the agro-industrial complex of the Altai Republic are effective, because they lead to the implementation of a more attractive scenario from the economic point of view.

5. Conclusions

1. It is revealed that in current economic conditions the agro-industrial cluster is the most promising form of integration structure contributing to the sustainable development of the national agro-industrial complex. The advantage of the cluster form of integration is its innovative nature in providing for the systemic synergistic interaction of economic entities, as well as government bodies, and scientific and educational institutions.

2. A methodology has been developed for assessing extra- and intra-integration structures consisting of three levels of assessment of the economy of the agro-industrial sector: the regional level, the economic sector level, and the enterprise level. To assess the industry (level 2) from the point of view of prospects for development of integration, a methodology has been developed based on the compilation of the integration decision-making matrix. The matrix describes the integration opportunities in the agro-industrial sector of the region in terms of growth and production efficiency. The matrix is based on a system of indicators: the coefficient of localization of the industry, and the potential for growth in production in the industry of the region, defined as the sum of the resource, investment,

marketing, and personnel potential of the agricultural sector. The third level of enterprise evaluation is supplemented by a calculation of the synergistic effect of integration based on the effect of scaling. The proprietary methodology was tested on the materials of the Altai Republic.

3. As a result of testing the three-level assessment of the prospects for agro-industrial integration, it has been determined that the livestock industry has the maximum potential for creating large integrated structures in the Altai Republic. The need for creating cluster structures as a form of integration units in the livestock industries of the Altai Republic has been substantiated.

4. The study offers 'business-as-usual' and target scenarios for the development of the agro-industrial complex of the Altai Republic until 2025. The effectiveness of the proposed measures is reflected in the target scenario for the development of the agro-industrial complex of the Republic, according to which the formation of intra-clusters and extra-clusters in 2025 will lead to an increase in total profits of enterprises in the livestock industries under analysis by 451 million rubles and budget allocations by 194.3 million rubles.

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