Agro-industrial integration in modern conditions

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Abstract. In the context of modern regional development strategies, much attention is paid to agriculture. Socio-economic development of most regions is impossible without active renewal by modern methods and approaches of the agricultural industry. The article discusses the integration processes of the agro-industrial complex. The information base of the study was made up of statistical materials of social and economic development of the regions of the Siberian Federal District. Economic methods of agricultural development analysis were used as research tools, as well as the method of calculating Grubel-Lloyd integration indicators. The first part of the article considers agro-industrial processes, which are the basis for improving the efficiency of the regions through the development of the agricultural industry, which is facilitated by integration processes. The second part of the article carries out calculations of integration processes and proposes an econometric approach to measuring the integration of agricultural enterprises on the basis of building ranks on the indicators of density, differentiation and interconnectedness of intraregional processes. Integration criteria of SFO regions were also calculated and justification of "necessity" and "possibility" of implementation of agro-industrial integration was fulfilled. On the basis of the presented material, qualitative reform of programs for the development of agro-industrial complexes is possible due to integration processes.

1. Introduction

The agricultural sector in Russia is experiencing a new round of development associated with various forms of integration. Currently, more and more agricultural enterprises are united in unions, agglomerations and holdings that operate within the framework of cooperation [1]. The most common form of integration interactions between participants in the producer chain is the agro-industrial cluster [2]. Cluster organizational form of management contributes to the most efficient allocation of resources, reducing production costs [3].

2. Problems of integration of agricultural enterprises

Modern agricultural enterprises are most in need of integration processes that strengthen economic ties by not only removing barriers to cooperation, but also by implementing integration advantages.

As a result of the analysis of research by scientists, it was revealed that the majority of agro-industrial enterprises don’t meet the requirements of modern conditions, which is due to the following factors:

- lack of modern methods of organizing agricultural production [4];
- lack of coordination between structures [5];
imperfection of the information base and effective system of informatization of the agro-industrial complex [6];
- lack of qualified personnel;
- lack of competent management skills in the field of integrated structures [7];
- low innovative development of agriculture [8].

The specifics of the functioning of the agro-industrial complex also determines the conditions for the integration of participants in agricultural production. This is due to production prices of agriculture, which largely depend on natural and climatic conditions, the need for long-term storage of products and their processing [9].

The full cycle of functioning of agricultural production includes the activities of various divisions that differ in their functions: main and auxiliary. At the same time, various integration links appear in the process of interaction. As a rule, many economic entities related to the internal and external environment of the agro-industrial complex take part in the production chain of the agro-industrial complex [10, 11].

Thus, the modern production cycle of the agro-industrial complex can be represented as a system of integrated relations of its participants. Therefore, the level of integration of organizational and communication processes determines the effectiveness of the results of each participant in the agro-industrial complex, as well as adaptation to external changes.

The motivation for the integration processes is the desire of agricultural enterprises to reduce risks and increase competitiveness by reducing production costs [12].

3. Indicators of socio-economic development of regions

In Russian practice, there is a variety of organizational and integration forms of interaction between participants in agricultural production: associations, unions, nonprofit partnerships and alliances, which are most effective at the interregional level.

The variety of existing forms of integration in modern conditions is characterized by fundamentally new mechanisms of relationships based on contractual relationships, mergers, joint ownership, etc. [14].

The main effect of integration processes in the agro-industrial complex is to increase the efficiency of activities due to a number of factors that lead to an increase in the profit of each of the participants in the integration processes [13].

Thus, the integration of agro-industrial enterprises is a natural process of adaptation to the modern economy, when there is an increase in the closeness of relationships and the involvement of economic entities in a single economic turnover. Agricultural integration is an important indicator of the socio-economic development of regions. The intensity of integration processes in agriculture is closely related to the potential of agro-industrial development of the territory, which can be assessed by indicators that determine the quality of the economic space of the regions [15]. These are indicators of density, differentiation and interconnectedness.

Thus, the potential conditions for integration processes can be judged by the main characteristics of the regional complex (table 1).

The table 1 is compiled by the authors based on statistical data [16].

The subjects of the Siberian Federal District have different conditions for the development of the agricultural sector. Most of the regions of Siberia are developing at the expense of industrial sectors, also due to mineral deposits.

The leading position was taken by the Altai Territory in the course of ranking regions on all three indicators of integration ability. In addition, the most susceptible regions for integration processes in agriculture are the Omsk Region, the Novosibirsk Region and the Republic of Khakassia.

In general, the calculation of indicators of "readiness" of the regions of the Siberian Federal District for integration processes in the field of agriculture showed that the economic space of many regions is ready for integration processes in agro-industrial production.
Table 1. Characteristics of the conditions for agricultural integration of the Siberian Federal District regions (2018).

| The regions of the Siberian Federal District | Density | Differentiation | Interconnectedness | Total rank | Average rank |
|---------------------------------------------|---------|-----------------|--------------------|------------|--------------|
|                                             | Gross regional product (GRP) per unit area (million rubles / ha) | Rank by density | The turnover of agricultural products per capita | Rank by differentiation | Road density km per ha of agricultural territory | Rank by interconnectedness |
| Republic of Altai                           | 89.87   | 7               | 38.63              | 3          | 40.72        | 9              | 19           | 6.33         |
| Republic of Buryatia                       | 22.25   | 10              | 22.29              | 7          | 65.25        | 10             | 27           | 9.0          |
| Republic of Tuva                           | 2.42    | 12              | 12.85              | 11         | 110.37       | 12             | 35           | 11.67        |
| Republic of Khakassia                      | 242.85  | 5               | 27.66              | 4          | 23.93        | 7              | 16           | 5.33         |
| Altai Territory                            | 593     | 1               | 53.59              | 1          | 6.87         | 3              | 5            | 1.67         |
| Trans-Baikal Territory                     | 52.12   | 9               | 20.98              | 8          | 73.46        | 11             | 28           | 9.33         |
| Krasnoyarsk Territory                      | 3.0     | 11              | 2.5                | 12         | 18.26        | 4              | 27           | 9.0          |
| Irkutsk Region                             | 79.89   | 8               | 25.75              | 6          | 35.11        | 8              | 24           | 8.0          |
| Kemerovo Region                            | 501.86  | 2               | 17.82              | 10         | 18.3         | 5              | 17           | 5.67         |
| Novosibirsk Region                         | 298.92  | 4               | 19.06              | 9          | 8.021        | 2              | 15           | 5            |
| Omsk Region                                | 408.11  | 3               | 46.13              | 2          | 4.61         | 1              | 6            | 2            |
| Tomsk Region                               | 91.45   | 6               | 26.67              | 5          | 21.52        | 6              | 17           | 5.67         |

An important characteristic of integration processes is the analysis of inter-regional and intra-industry trade, which can be calculated based on the Grubel-Lloyd index [17]:

\[
GL_{ci} = \frac{X_{ci} - M_{ci}}{X_{ci} + M_{ci}}
\]

where \(X_{ci}\) – export of agricultural products from the region; \(M_{ci}\) – import of agricultural products into the region.
Based on statistical data for the regions of the Siberian Federal District, the level of intra-industry integration was assessed (table 2).

| The regions of the Siberian Federal District | Export of agricultural products (ton) | Import of agricultural products (ton) | Level of intra-industry differentiation (\(GL_{ai}\)) |
|---------------------------------------------|---------------------------------------|----------------------------------------|-----------------------------------------------|
| Republic of Altai                           | 3908.6                                | 121199.9                               | 0.142                                         |
| Republic of Buryatia                       | 5202                                  | 19332.4                                | 0.424                                         |
| Republic of Tuva                           | 148                                   | 342.5                                  | 0.603                                         |
| Republic of Khakassia                      | 3448                                  | 21722.7                                | 0.274                                         |
| Altai Territory                            | 1055714                               | 174984.4                               | 0.284                                         |
| Krasnoyarsk Territory                      | 44383.6                               | 130341.5                               | 0.508                                         |
| Irkutsk Region                             | 33862                                 | 182058.5                               | 0.314                                         |
| Kemerovo Region                            | 62644.2                               | 65864.7                                | 0.975                                         |
| Novosibirsk Region                        | 57817                                 | 378518.2                               | 0.265                                         |
| Omsk Region                                | 215561                                | 114851.7                               | 0.695                                         |
| Tomsk Region                               | 29515.9                               | 95659.4                                | 0.472                                         |

The intra-industry integration index takes a value from 0 to 1. The index value close to 1 indicates a high use of integration links within the agricultural sector of integration for any regions, taking into account the possibility of exchanging agricultural products. This technique provides a general calculation of the integration processes related to intra-industry trade at the inter-regional level, which allows us to assess the prospects for interest in regional interactions, taking into account the individual capabilities and needs of each region. Interregional agricultural integration is an organizational and economic process of interconnection of regions through the exchange and movement of agricultural products, labor resources and capital based on the division of labor and resources in the single economic turnover.

4. Implementation plans for agro-industrial integration

Integration processes are an important indicator of the socio-economic development of the national economy, since the intensity of inter-regional interactions increases the efficiency of functioning of regions in a single regional space [19, 20]. Strengthening regional interconnections within the framework of integration processes helps to equalize the socio-economic situation of regional economic entities by creating effective production proportions, implementing joint investment projects, expanding the boundaries of interaction, improving the standard of living of the population, etc.

The processes of agricultural integration need an institutional and legal framework that contributes to the formation of administrative and managerial tools to stimulate the interconnections of agro-industrial complexes. At the same time, integration processes should be reflected in the development strategy of the Siberian Federal District, taking into account individual priorities and integration processes of agricultural territories that are part of the Siberian Federal District.

Integration processes in agricultural sectors are unavoidable in the implementation of strategic plans for the development of the national economy, since there are real prerequisites and conditions for the implementation of integration processes (figure 1).
5. Conclusion
Integration processes in the agricultural sector are a necessary condition for the further development of agro-industrial enterprises, as they contribute to the formation of the most optimal conditions for the effective operation of agricultural industries. Moreover, there are conditions for integration processes in almost every region.

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