

Cross-sectoral approach to improving integration processes in agro-industrial complexes

Enfoque intersectorial para mejorar los procesos de integración en complejos agroindustriales

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ABSTRACT:

This work focuses on contemporary issues of integrated development of regional agro-industrial complexes. Using the cross-sectoral approach, certain principles have been developed for the formation of clusters for manufacturing and processing basic livestock products, which provide more rational manufacture, processing, transportation, marketing and distribution of resources by geographically scattered entities, thereby increasing autonomy of agro-industrial complexes through cooperation with engineering industry and use of alternative fuels. There have been determined reserves for the development of integrated entities in livestock breeding of the Altai region. The cross-sectoral approach to the formation of an innovative cluster is used, where enterprises of particular agro-industrial complex interact within the technological chain: science and education, production, processing, distribution of finished products, authorities, infrastructure, and agricultural machinery industry. The developed principles can be applied to regions with favorable conditions for cultivation of rapeseed and without own

RESUMEN:

Este trabajo se centra en temas contemporáneos de desarrollo integrado de complejos agroindustriales regionales. Utilizando el enfoque intersectorial, se han desarrollado ciertos principios para la formación de clusters para la manufactura y procesamiento de productos básicos de ganado, que proporcionan una fabricación, procesamiento, transporte, comercialización y distribución más racionales de los recursos por entidades geográficamente dispersas, incrementando así la autonomía de los agro -industriales mediante la cooperación con la industria de la ingeniería y el uso de combustibles alternativos. Se han establecido reservas para el desarrollo de entidades integradas en la cría de ganado de la región de Altai. Se utiliza el enfoque intersectorial para la formación de un cluster innovador, donde las empresas de un determinado complejo agroindustrial interactúan dentro de la cadena tecnológica: ciencia y educación, producción, procesamiento, distribución de productos terminados, autoridades, infraestructura y maquinaria agrícola . Los principios desarrollados pueden aplicarse a regiones con

oil resources.

Keywords: agro-industrial complex, model, cluster, cross-sectoral approach, knowledge based capital, alternative fuels.

condiciones favorables para el cultivo de semilla de colza y sin recursos propios de petróleo.

Palabras clave: complejo agroindustrial, modelo, cluster, enfoque intersectorial, capital basado en el conocimiento, combustibles alternativos.

1. Introduction

In the context of aggravation of the food security problem and import substitution, the state policy has provided favorable terms for the development of agro-industrial complexes. Though the country's economic growth cooled down, the agricultural production index for 2011 was 112.4% according to the Ministry of Agriculture of Altai region, i.e. the development trend was observed for the Altai agro-industrial complex. The measures introduced in response to the sanctions of the Western countries became a unique opportunity for the Altai agricultural producers to realize their accumulated potential and enter new markets, fully fill their capacities for the production of raw materials, processing, transportation and trade. Thus, there is an objective need to apply the cross-sectoral approach while developing priority areas for the formation of effective market structures and mechanisms of state regulation of agro-industrial complexes.

In the current economic situation, an additional obstacle for the development of agro-industrial complexes is the depreciation of rouble and the fuel cost increase, which led to rising prices of commodities and finished products, and consumer prices. Therefore, cross-sectoral cooperation is of particular importance, and close relations with the agricultural machinery industry become a necessity. This will increase the efficiency of production and reduce fuel consumption in agricultural work. Since the current fuel prices are high, it is necessary to use energy alternatives, which are not only economically advantageous, but also meet environmental standards.

It is important to create a closed technological chain: suppliers of commodities, materials and means of production; developers of new technologies in agriculture; processors and distributors. In other words, it is necessary to balance activities of the agriculture and processing industry. The "manufacture — processing — distribution" principle should be applied to establish a single production cycle, and it requires production facilities and skilled workforce that can be provided by cooperation of universities and processing enterprises. As a result, quality will be improved, stability of the system as a whole will increase, as well as volumes of production, but transaction and unit production costs will decrease, hence competitiveness of domestic products on the world market will grow. Establishing these economic structures is possible through cooperative integration processes.

2. Methodology

2.1. Study of Foreign and Domestic Experience

Having analyzed studies on the formation and development of cooperative and integrated agro-industrial structures, it should be noted that relevant domestic and foreign theory and practice define "agro-industrial integration" as establishing production and economic systems between agricultural entities and totality of their economic and legal relations.

This analysis is summarized in Table 1 (Porter, Michael E., 2008), where views of foreign and Russian scientists to the nature of agro-industrial integration and creation of integration formations in agro-industrial complexes are presented.

Table 1. Features of Agro-industrial Integration

Author	Main Features	Advantages
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1	2	3
Coase R. H., 1990	Theory of Integration and Transaction Expenses (Consolidated information collection, marketing, trade enquiries, negotiation, etc.)	Optimization of transaction expenses
Fiexner K. F., 1989	Integrated formations in agro-industrial complexes (Consolidating the forces of delinked producers, increasing the potential of all available resources)	Increasing the effectiveness of all participants in agro-industrial integration
Deighton A., 2015	Basic principles of successful integration in agro-industrial complexes: principle of voluntariness, timeless factor (including economy, politics, security, social sphere), correlation with decision-making procedures	Equality of all participants in integration processes
Korolchuk A.K., 2001	Integration is an objective necessity for businesses in agro-industrial complexes (it follows from the requirements of accelerated development of production)	Consolidation of funds to manufacture new types of products
Tkach A.V., 2006	It contributes to the restoration of business integration (it unites previously isolated parts, phenomena, processes and develops links)	Absence of barriers between economic entities
Maksimov M.M., 2006	Integration is the main trend in the development of advanced agribusiness, this is due to structural shifts in agro-industrial production in transition economies	Development of productive forces, optimized utilization of manpower resources
Kundius V.A., 2008	Agro-industrial integration is a complete form of cross-sectoral vertical cooperation, organizational and economic integration of agrarian, industrial, and trade enterprises into a single whole - agro-industrial economic system	Development is focused on meeting the people's food needs
Poltorakhin A.L. (Kundius V.V., 2008)	Agro-industrial integration is a diversified multi-level process, when companies and their associations are united in a wide variety of forms called transnational corporations (TNCs). Their essence lies in establishing large-scale associations of credit and financial, industrial scientific and technical, trade and service structures in agro-industrial complexes	Such unions operate not only in the country where the majority member is resident, but also worldwide

Peculiarities of agro-industrial integration abroad: in most cases, it is focused on agriculture, but directly or indirectly initiated and coordinated by non-agricultural businesses. Peculiarities of agro-industrial integration abroad are summarized in Table 2 (Balassa B., 1962; Balassa B., 1976; Soulie D., 1989; Zapolsky M.I., 2010). USA, Canada, England started industrialization of agriculture in the second half of the 1930s, Western and Northern Europe — in the first half of the 1950s (Coxhead, I. and Southgate, D., 2000), and integration processes in Japan began only in the 60-70s of the 20th century (Dahmen E., 1950, Toledano J., 1978). Dahmen E., 1950; Toledano J., 1978

Table 2. Peculiarities of Agro-Industrial Integration Abroad

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Countries	Form of Integration	Features
UK, Italy	Contract system of relations	Raw materials are sold to processing companies under the contracts (vertical integration). Advantages for farmers: guaranteed sales and prices, loans and technical assistance. Advantages for processors: guaranteed deliveries of products by farmers
USA	Supply and distribution entities	Large industrial monopolies with their own dealer network, farming supply cooperatives, dealer firms
Northern Europe (Sweden, Denmark, Norway, Finland)	Agricultural cooperatives	Cooperatives are the initiators of stable links between agriculture and other sectors of economy (they play an important role in processing and marketing of agricultural products, and services for farmers)
France	Trade associations	Regulated by the government and state authorities to a significant extent
Japan	Cooperatives	Cooperatives are mainly engaged in supplying rural commodity producers with means of production and marketing of products, lending, processing of agricultural products, etc.
Belarus	State-owned agricultural entities	Particular attention is paid to the need for further developing cooperative integration processes in agro-industrial complexes and creation of agro-industrial food and diversified entities based thereupon
Ukraine	Holdings, agroholdings	Private integrated entities prevail
Eastern Europe (emerging countries)	Holdings	Processors are the main integrators

Unlike in the developed countries, integration and cooperation processes are not sufficiently developed among agricultural enterprises in Russia. Studies show that vertical integration is the most effective way for agro-industrial complexes. For the Altai region, horizontal type of integration is the most typical for agro-industrial complexes. There are a great number ($\geq 2,000$) of food and processing enterprises in the region, of which 400 are large and medium-sized. Specific form of integration should be noted, namely scientific and production associations, including research and agricultural units. Horizontal integration leads to interfarm cooperation of collective and state farms and other state enterprises while arranging certain production on an up-to-date technical basis, including industrial methods and progressive technologies. Recently, introduction of new methods of management has become a distinctive feature of innovative processes in agro-industrial complexes of the region. Vertically integrated agro-industrial complexes and agrarian enterprises with a closed production cycle are created and developed in crop production and animal husbandry.

The goal of managing the development of integration processes is the transition of production systems to an integrated state or strengthening ties that ensure the achievement of a synergetic effect, increasing efficiency and competitiveness. The achievement of this goal is ensured by the creation of new integrated units that are oriented towards obtaining the effect

of coordinated joint activities, as well as by the preservation of current integrated structures (Cramer G., Jensen C., and Southgate D., 2001).

Increasing the efficiency of agricultural production should be ensured by the creation of agro-industrial formations of various forms of business ownership that unite agricultural, processing, trading, banking, insurance and other structures. Modern trends in the development of global and domestic economies, factors of external and internal environment of organizations contribute to the development of integration processes, emergence of new forms of association of entities. They should promote intensive development of production, approve the equivalence of exchange at the intra- and cross-sectoral levels, increase competitiveness and efficiency, and create conditions for the financial stabilization of enterprises.

The main objectives of integration, association of economic entities in current conditions are summarized in Figure 1.

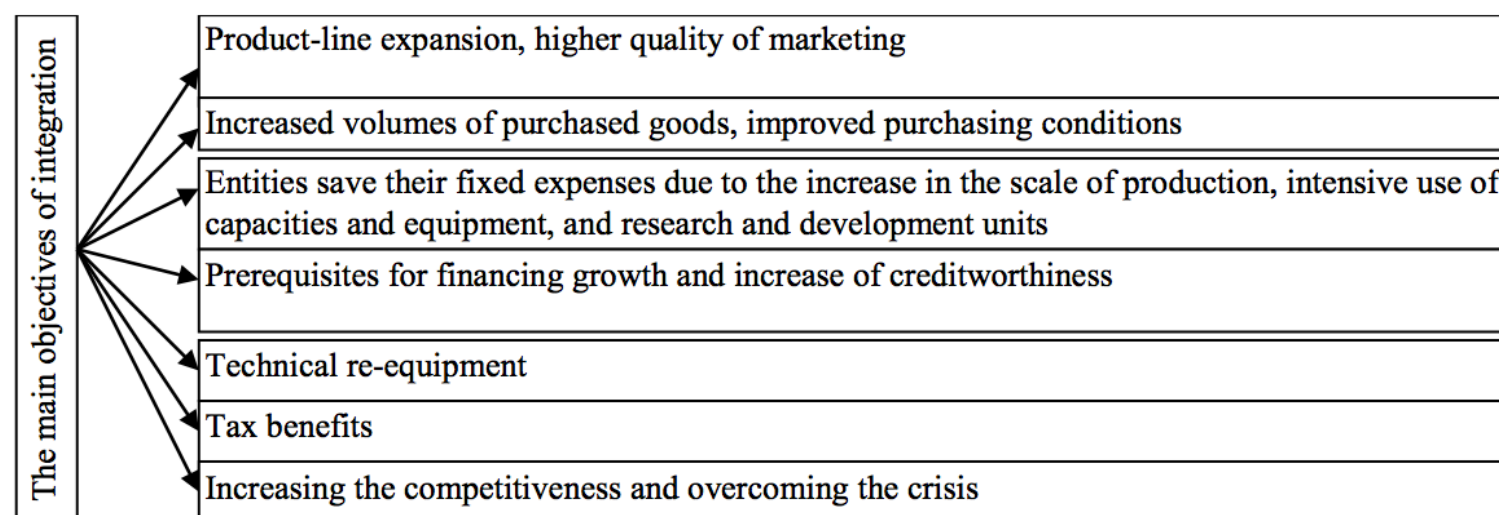


Figure 1. Main Objectives of Integration, Association of Economic Entities in Current Conditions

As a result of interaction and association of several enterprises (entities) within the new economic structure, a synergetic effect arises, when joint operation of such entities exceeds the sum of the effects from their autonomous operation.

Several clusters successfully operate in the Altai region, which are established on the basis of regional natural, historical and social advantages. The Altai biopharmaceutical cluster is one of them. Its main competitive advantages are biopharmaceuticals and bioparafarmaceuticals activities based on the use of the unique natural resources of Altai. *The Altai Priob Integrated Development Project* is designed to develop the regional industry potential using established agricultural clusters — production of grain, dairy, meat, sugar and oilseeds, as well as scientific research and educational institutions. For the Altai region, the most effective method of economic development is to proceed with consolidation of enterprises of various industries to create such clusters.

2.2. Developing the Methodology for Cluster Formation

At the IIIrd International Scientific and Practical Conference *Sustainable Development: Society and Economics* held on April 21, 2016 in St. Petersburg Mr. Christopher Pissarides, Nobel Prize in Economics, Head of the Economic Growth Research Laboratory at the St. Petersburg State University, said that Russia should have forgotten about its oil and focus on increasing the level of competition in the corporate sector in order to return to the recent GDP growth. He recommended the Government to focus on structural reforms to increase the competitiveness of industries.

Thus, when food security and import substitution in agriculture are of a great importance, particular focus should be made on self-sufficiency of agro-industrial complexes and their independence from resource prices (Southgate, D. (2011)). Since the prices of fuel rise, alternative fuels should be used. For example, vegetable-based fuels will not be only

economically beneficial, but also meet environmental standards.

Some problems are listed herein below that can be solved in cooperation of the authorities, scientific and educational entities and agro-industrial enterprises:

1. In fact, there is no system of implementing innovations into agricultural production in both Russian and foreign agrarian science. It is necessary to create, with the support of the state, an effective and economically justified mechanism that could interest both agrarian businesses and science. In this matter, it is interesting to study the experience of Belarus, where several scientific and practical centers have been established by the National Academy of Sciences with the status of republican unitary enterprises.
2. There is a problem of insufficient motivation of agricultural managers to implement innovative technologies.
3. One of the most important tasks is to involve agrarian education to the innovations to the fullest extent. In this regard, links between agrarian universities and advanced basic farms should be established.
4. It is necessary to intensify research and implementation in agrarian universities, and create conditions for complete fulfillment of the potential of young scientists.

Based on the development of solutions of such and other problems, the methodology for the formation of livestock clusters in the current economic situation has been supplemented and implemented, which was complicated by the requirements of the World Trade Organization (WTO).

The main provisions of the methodology include the following ones:

1. To identify the most promising sectors of the economy in the selected region, taking into account its natural and economic potential.
2. To analyze the availability and composition of the resource base: agricultural land, production capacity, production and market infrastructure, etc.
3. To analyze the availability of resources to ensure the greatest autonomy of the regional agricultural sector.
4. To study the efficiency of alternative fuels usage in agriculture.
5. To analyze how effectively educational and scientific resources are used (relationship between vocational education and labor market).
6. To analyze the potential of administrative authorities, availability of sustainable links with scientific organizations and educational institutions.
7. To analyze the existing market infrastructure (availability and performance of financial institutions, leasing and marketing companies, logistics, storage, etc.).
8. To analyze and monitor the production structure (availability and assessment of production of breeding farms, veterinary services, production and technical services, etc.).
9. To evaluate the efficiency of the Coordinating Council, i.e. implementation of cluster policy tasks. To assess the cluster autonomy, when alternative fuels are used instead of diesel by agricultural machinery.

This methodology promotes more rational organization of production, processing, transportation, marketing, distribution of resources of geographically scattered entities.

3. Results

3.1 Analyzing Reserves to Form a Cluster

One of the main food market indicators depends on provision of the population with quality and affordable foods.

In order to implement the agro-industrial complex model properly, the following development reserves may be used:

1. Reserves to increase dairy and meat production in the natural and economic zones of the region. The region is divided into seven natural and economic zones with various dairy and meat production concentration. Livestock of cows and production of dairy are concentrated in five natural and economic zones: Kulunda, Prialei, Biysko-Chumysh, Priob and Prialtai. Among them the Biysko-Chumysh zone has the smallest agricultural land area, and due to this, its initial stock density and output per 100 ha of agricultural land is one of the highest in the region.

Livestock of farm animals and meat production is concentrated in the Priob and Kulunda natural and economic zones. The revealed disproportions are among the main causes why raw materials are lost during transportation and storage, as well as their high-cost production. Consequently, there are reserves to increase the number of agricultural animals and dairy and meat production in each natural and economic zone of the region.

2. Reserves to optimize the total production capacity. The dairy processing regional capacity amounts to 1,924.7 thousand tons per year, meat - 385 thousand tons, and provided with raw materials, respectively, by 75.3% and 57.6%. The dairy and meat production capacities are used for less than 50%, so there are significant reserves to increase the production of the final products.

3. Reserves to increase the acreage. In the Altai region, the arable land is 6.5 million ha and the sown areas occupy 5.5 million ha, thus a significant increase in crop areas is possible.

4. Based on the cost, availability and physical and chemical characteristics, rapeseed oil, which can be used as a fuel base or a component thereof, is most suitable for fuel production in the Altai region. The most favorable areas for growing rapeseed are located in the south-east of the region — Bystrovostok, Smolensk, and Petropavlovsk regions.

5. A number of problems have been identified while forming and using human capital in the agrarian sector of the Altai region: decrease in the professional level of managers and specialists; unbalanced and unstructured agrarian labor market; absence of productive cooperation of employers, science and education to establish requirements for training and building a graduate model; and decline in the prestige of agrarian education and agricultural labor.

6. The imperfect relationships between agricultural producers, processing and trade enterprises of the region have been revealed. The monopoly of dairies and meat factories makes it possible to undercut the prices of raw materials, which results in the reduction of the raw material base, and it is of great importance for the farmers to ensure guaranteed sales, taking into account their seasoned production of milk and meat.

3.2. Forming an Animal Husbandry Cluster

The main driving force of the cluster is a balanced fodder production, specialized agricultural organizations that form raw material base of processing enterprises of each natural and economic zone in the Altai region (in Figure 2 - 1. Prialei natural and economic zone, 2. Kulunda natural and economic zone, 3. Altai natural and economic zone, 4. Prialtay natural and economic zone, 5. Prislair natural and economic zone, 6. Priob natural and economic zone, 7. Biysko-Chumyshs natural and economic zone). Moreover, the cluster members are administrative authorities, science and education (cooperation of employers and educational institutions, businesses and scientific organizations), market infrastructure (financial and credit entities, leasing and marketing companies, logistics, storage, etc.) and production infrastructure (breeding farms, veterinary services, production and technical services, etc.). Each member of the cluster is represented in the Coordination Council created to distribute the

functions. To ensure the greatest autonomy of the cluster, a close interaction of engineering enterprises (modernization of engines for the most efficient use of biofuels) and agricultural organizations (growing rape seed to produce biodiesel) is required (see Figure 2).

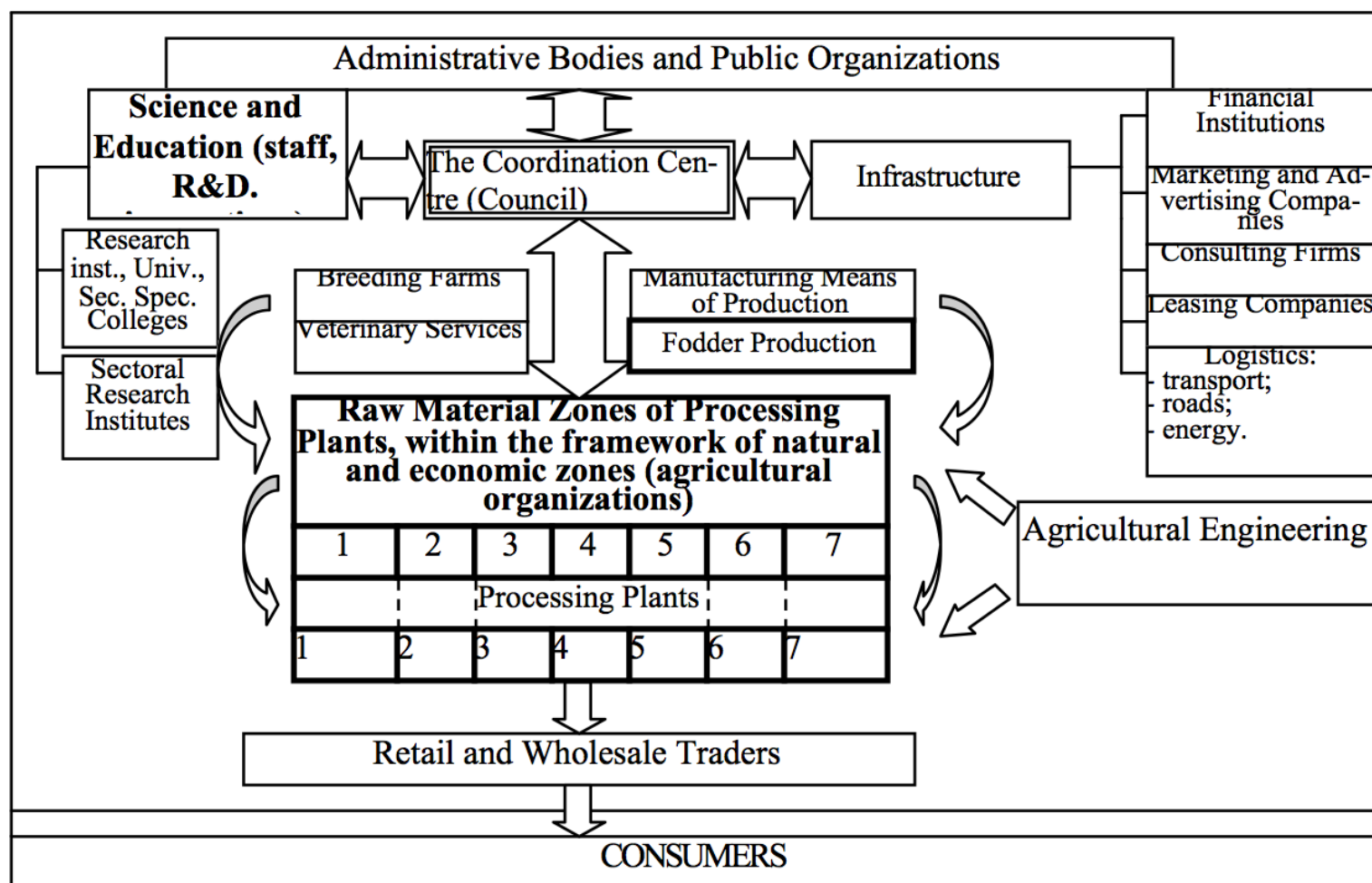


Figure 2. Cluster Structure of Food Subcomplexes — the Altai Agro-industrial Complex, Based on Cross-Sectoral Cooperation

The methodology is designed to find the best ways how to meet the population's needs for high-quality and affordable products, as well as for loading processing capacities and eliminating shortcomings in the structure of commodity circulation. Integration relationships, including information exchange, are becoming an increasingly important factor of competitiveness, which affects performance of other factors. Within the agrarian cluster, the Altai region can take territorial advantages in the production.

4. Discussion

At present, there is some irrational and inefficient use of educational and scientific resources in the Altai region: weak relationships of vocational education and the labor market have created an imbalance between the employers' requirements to employees and the quality of training (Matveev D.M.; Sycheva I.N.; Glotko A.V.; Shelkovnikov S.A.; Rudoi E.V., (2015)). It can be stated that education, science and business are disunited. The cluster is an effective tool for stimulating the development of professional agricultural education and, as a result, a promising tool for developing the intellectual capital of agriculture.

Indeed, such form of association as a cluster is formed on the basis of research organizations and universities, i.e. from which the production chain should begin: innovative developments, improvement and expansion of the assortment of final products and each production stage separately (Enright M., 2001). Important is the training of highly qualified personnel for each of the production stages. In the agrarian sector, the Altai region can take territorial advantages in the production within the cluster. Cross-sectoral relations will allow ensuring the country's food security and raising the standard of living of the population. This work proposes and implements a methodology to form livestock production clusters, which should help rationally organized production, processing, transportation, marketing, and distribution of resources by

geographically scattered entities.

The cluster core is formed on the basis of the existing natural and economic zones; the growth targets are agricultural producers and their associations, which provide raw materials for processors in each natural and economic zone (see Figure 2). Volumes of production of raw materials must correspond to the production capacities of the relevant natural and economic zone. Management is carried out by the Coordination Council, which consists of agricultural producers, processors, representatives of the production and market infrastructures, wholesale and retail networks that distribute the final products (Sycheva I.N.; Kuzmina N.N.; Permyakova E.S.; Svistula I.A., 2015).

Favorable prerequisites for creating the conditions necessary to accelerate the innovation process in agro-industrial complexes of the region can be created on the basis of support from the regional agribusiness management of not individual organizations and enterprises, but their associations. The most productive are associations that are created taking into account natural, climatic, historical and social factors. This approach is reflected in the concept of particularly important agrarian territories of the Russian Federation.

5. Conclusion

A cluster as the highest form of integration has been recently found in many sectors of the Russian economy. Its practical application in agriculture is less widespread than that in other sectors. Therefore, we have developed ways of implementing this form, which, unlike the existing ones, imply the improvement of the cluster form on the basis of achieving both an economic and social effect reflected in the satisfaction of the population's needs in food of own production. In the agrarian sector and within the cross-sectoral approach to integration improvement, the Altai region can take territorial advantages in the production.

Reserves to develop the livestock in the Altai region are determined. A reserve increase in dairy production makes 469.6 thousand tons per year, cattle meat — 101.7 thousand tons, and pork - 103 thousand tons. The efficiency of dairy and meat clusters of agro-industrial complexes assumes satisfaction of the needs of the region's population in dairy and meat products, as well as full utilization of the capacity of the regional processing enterprises. The total production capacity for processing milk is 1,924.7 thousand tons, for processing raw meat (excluding poultry meat) — 385 thousand tons, and the capacity for the production of dairy products — 1,630 thousand tons, meat — 237.7 thousand tons, while the population's need for milk will be satisfied by 146.3%, in meat — by 148.8%, which allows exporting products to the markets of neighboring regions.

The further implementation of cooperative integration in agro-industrial complexes and agricultural machinery will allow them to be transformed into new structures represented primarily by integrated agro-industrial structures for the production of raw materials, processing and sale, and by organizations engaged in scientific and technical services. In this situation, all enterprises of the complex will be interested not in intermediate, but in the final results of production, which will have a positive effect on the economic efficiency of all the links in the agro-industrial complex.

If the existing level of efficiency of the agro-food regional sector and the volume of state support are maintained, the possibilities for its development will be insufficient to improve the living standards of the rural population, sustainable reproduction of the material, technical, human resources and natural-ecological potential of agriculture and, ultimately, to ensure competitiveness of agricultural products in new economic conditions.

The developed principles can be applied to regions with favorable conditions for cultivation of rapeseed and without own oil resources. The global and Russian experience of such production modernization shows that this approach leads not only to improving economic indicators, but also to a significant improvement in the people's living conditions.

The results of this scientific research allow solving the problem of increasing the autonomy

of the agro-industrial complex, which is especially important in the current economic situation.

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