Trans-Border Agro-Industrial Cluster Formation and Development

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Abstract. The article considers the main features of trans-border agro-industrial cluster formation and development. The analysis of the concepts “agro-industrial cluster,” “trans-border agro-industrial cluster” is conducted. The main approaches to its formation and development from regional and national development point of views are analyzed. The assessment of formation competitive agro-industrial clusters potentials is presented. The formation stages of agro-industrial clusters are defined. The formation stages of agro-industrial clusters caused by process peculiarities of trans-border cluster are considered. The formation of competitive agro-industrial clusters should be based on the principles of viable systems modeling. The application of the given model in practice while planning the joint activity of businesses being a part of the trans-border agro-industrial cluster will allow to maximize the profit of the whole cluster and each of its national participants.

1. Introduction

In modern conditions of global crisis and increasing threats of further price growth on the world markets of agricultural products some aspects of agro-industrial complex competitiveness level rise for most countries in the world as well as their food security are particularly analyzed.

Nowadays in terms of international competition on the world agricultural markets, one of the main direction to make up competitiveness priorities for agrarian and other sectors of economy is to create a cluster as well as a trans-boundary one.

2. Background

Taking into account the tendencies of regional agro-industrial complexes development, it should be noted that the most important aspects are those which reflect the influence of different forms and types of integration on sustainable economic development, economic growth, product competitiveness of AIC products, investment attractiveness of the sector and regional one as a whole.
Focusing attention to the fact that agriculture has got some distinctive features from the others of the economic sector, it should be noted that economic and social progress on rural territories in the countries with transient economy as well as with a developed one is related to the ability to implement innovations and competitiveness into the agro-industrial complex on local and international markets.

As for researches of the cluster’s formation and development in agro-industrial complex with considering trans-boundary cooperation revitalization of the countries and regions, it should be stressed that many domestic and foreign scholars [1-10] studied these issues and nowadays they have been left less examined so far.

Moreover, such issues as the cluster’s formation and development in agro-industrial complex with considering trans-boundary cooperation revitalization of the countries and regions have been poor investigated yet. All mentioned above say presuppose the relevance of the research both in theoretical and in practical aspects.

3. Focus of the research
The process of agro-industrial systems’ formation in many countries of the world became more complex starting with the usage of biotechnology and finishing with a high degree of food products processing. It should be indicated that these enterprises more often work out various alliances with other participants of the system, forming new agro-industrial establishments – industrial clusters.

The founder of the cluster theory M. Porter defined four reasons of a cluster: historical circumstances, geographical circumstances (definite industries are always located on a definite place), innovations and a case [11, p. 219].

In 2003 International organization of United Nations Conference on Trade and Development (UNCTAD) conducted the research on the cluster’s formation and development and other network sectors of the economy which says that “clusters and other network sectors are one of the best variants of a small and medium-sized enterprises growth’s support and with their abilities to compete effectively within the global economy” [12, p. 8].

A scholar T. Adeboye identified the following classification for the agro-industrial complex where clusters are divided into three groups:
1) Clusters related to land activities directly as well as to natural resources (agrarian clusters in forestry, sea food clusters etc.);
2) Agro-industrial clusters (specialized in raw processing, and tend to differentiate their products and implement innovations);
3) Fully industrialized food clusters, with a high share of added value and with complex production technology application [13, p. 1532].

Clustering in the Russian Federation has acquired an all-embracing nature. Clusters are being formed and developed in the majority of the Russian regions. 25 regional innovative clusters are officially recognized by the state. While additional 27 agro-industrial clusters and seven clusters of food processing industry are being formed [14].

An academian A. Chernyaev considers two types of agro-industrial clusters in his researches which differ from each other by their way of formation: integrated ones (unite all enterprises from various sub-complexes) and associated ones (formed on the basis of the already existing clusters from different sub-complexes of AIC – agro-industrial clusters). A scholar suggests considering the formation of the simplest associated agro-industrial clusters because in domestic practice there is no positive experience of doing an integrated one. The matter is that not all regions have all required enterprises of various sub-complexes, needed to form a full-scale agro-industrial cluster [15, p. 6].

According to O.V. Bogdanova regional agrarian cluster is first of all an organizational form of efforts consolidation of the enterprises and establishments of the definite region, directed to supply their food security. Joining of the agro-industrial producers to a cluster is undoubtedly to increase greatly the effectiveness and competitiveness of agricultural production both on the level of a separate taken enterprise and on the level of a definite region as a whole [16].
Developing the ideas of this approach O.A. Anichkina thinks that agro-clusters are an association based on the principle of trust between the participants and the decisions of the controversial questions by the arbitration court. One of the most important tasks of small and medium-sized enterprises agro-clusters formation in the sphere of agricultural production is their adjustment to permanent changes of competitive environment and market demand as well as the decreasing of agricultural raw and products market power on commodity markets of various regions of Russia [17, p. 39].

Applying the functional approach S.A. Ernst believes that an agro-industrial cluster is a territory-localized innovative-oriented integrated structure which is formed on the basis of agro-industrial and agricultural productions. The mail goal of such structure is to create an industrial basis for further increasing of competitive priorities and productivity of the region food sphere as well as a complex usage of existing social-economic potential of the country’s territory [18, p. 6].

E.V. Chemodanova stresses that an agro-industrial cluster is a territory-industrialized union, a partnership of the agro-industrial enterprises, financial organizations, governmental structures and scientific institutions, an integration of which let economic resources used optimally and strengthen competitiveness of the industry and the economy of the regions and a country as a whole [19].

According to A.S. Huhrin the process of the agro-industrial cluster formation is “a difficult one itself, their formation throughout the territory of Russia and regions is the most reliable way to decrease the cost price of the resources used, a number of capital investments into producing of a one product unit and labour costs of the workers” [20].

Summing up the mentioned above approaches [13-21] of defining the essence of a notion “agro-industrial cluster”, it is believed that it is possible to consider it to be as an innovative-directed, territory-localized, inter-industrial integrated structure with the elements of the network organization based on cooperation which is made up upon agricultural production and includes different spheres of AIC, comprising into market chain to set up added value as well as providing service, infrastructure establishments and national and local institutions with agro-producers’ support and there may be an interaction with a science.

Taking into account the peculiarities of the given approaches, an agro-industrial cluster is suggested to be considered as a system (network) of geographic concentrated subjects of the agricultural market presenting different industries and types of activities (R&D institutions, universities, private subsidiary households, farms, agricultural enterprises, authorities etc.), dealing with R&D, production and innovation products application and having unique competitive priorities of the location, an innovation technology application, know-how, a system of the cluster organization.

In recent decades clusters began intensively their development as well as other network forms of trans-border economic cooperation within boundary regions. This form is widely spread in the European Union. The analysis of agrarian policy in the member-countries of OECD showed that the majority of EU countries use such form of trans-border economic cooperation as clusters as well as those which are related to the agrarian sector, food industry and rural territories’ development.

Moreover, it is necessary to give a definition of a trans-border agro-industrial cluster as a regulatory, clearly spatial formation which includes boundary agro-industrial complexes of not less than two neighboring regions of the country which have a common border. The aim of its formation is to stimulate jointly and on agreed basis the development of the agro-industrial clusters.

4. Solutions, results and recommendations
Agro-industrial clusters formation presupposes to run some investigations both on regional and national levels to define the competitive advantages of the region.

Wherein the revitalization of competitive potential complex assessment enables to reveal their competitive priorities and basic factors restraining the definite region development aiming to work out the strategies of the clusters development in the region. Therefore, taking into account mentioned above, it is considered that it is necessary to make an assessment of opportunities to form agro-industrial clusters and their stages of development in the following sequencing (table 1).
Table 1. Opportunities’ assessment to form agro-industrial clusters and stages of the agro-industrial clusters formation.

| Opportunities’ assessment to form agro-industrial clusters | Stages of the agro-industrial clusters formation |
|----------------------------------------------------------|--------------------------------------------------|
| 1. formulating of the goal and setting tasks              | 1. a project preparation                          |
| 2. choosing methods of assessment, criteria and indicators of assessment as well as alternatives for carrying out comparison | 2. analytical processing                          |
| 3. checking data available, their collection and processing | 3. strategy development                           |
| 4. data analysis and results interpretation               | 4. long-term development planning                 |

Establishing a trans-border agro-industrial cluster, it should be stressed that it is necessary to answer one question: How to form the organizational structure of the future clusters in order to have this system viable as a whole? Figure 1 shows the stages of forming a trans-border agro-industrial cluster, sequencing and contents of these stages. They differ from those shown in Table 1. They are caused by the peculiarities of trans-border cluster formation.

Figure 1. Stages of trans-border agro-industrial cluster formation.

It is also important to take into consideration that a competitive trans-border agro-industrial clusters formation should be based on the principles of viable systems modeling. The structure of the joint
production should be optimized to maximize profit of the whole cluster and its members in the framework of a trans-border agro-industrial cluster to reach a definite degree of economic activity integration by agricultural producers – participants of the cluster. It is recommended to do by applying linear programming method.

According to this model, it is important to find such \( x_{ij} \) with the help of which a maximum profit can be achieved (this type of a task requires to find a minimum, so a profit value is taken with a minus)

\[
R = \sum_{i=1}^{n} \sum_{j=1}^{l} - (p_j \cdot y_{ji} - c_{ij})x_{ij} \rightarrow \min,
\]

herewith restrictions of the plot of land total area and an area for growing separate crops should be considered to preserve the balance of areas:

\[
\sum_{j=1}^{l} x_{ij} = b_i \quad (i = 1,2,\ldots,n)
\]

\[
\sum_{i=1}^{n} x_{ij} = a_j \quad (j = 1,2,\ldots,l)
\]

\[
\sum_{j=1}^{l} a_j = \sum_{i=1}^{n} b_i
\]

where:
- \( R \) – cluster’s profit
- \( i \) – a plot of the land number, \( i = 1,2,\ldots,n \);
- \( j \) – a type of a crop, \( j = 1,2,\ldots,l \);
- \( b_i \) – an area of \( i \)-plot of the land, ha;
- \( a_j \) – an area for growing a \( j \)-crop, ha;
- \( y_{ji} \) – a yield of \( j \)-crop of \( i \)-plot of land centners / ha;
- \( p_j \) – weighted average price 1 centner of \( j \)-crop on the markets of member-countries of cooperation (in currency chosen for calculations)
- \( c_{ij} \) – cost price of 1 centner of \( j \)-crop growing on \( i \)-plot of land (in currency chosen for calculations)
- \( x_{ij} \) – sought

Applying of this model while planning the joint activity of the economic activity subjects comprising the trans-border agro-industrial cluster allows to maximize profit of the whole cluster and each of its national participants. In the same time to prevent conflicts between participants of the trans-border agro-industrial cluster it is necessary to work out and confirm methods of profit distribution at the general meeting which can happen as a result of economic activity optimization in the framework of a trans-border cluster.

5. Conclusion

Thus, a cluster form of trans-border cooperation in the agro-industrial complex can provide both a complex itself and rural territories with a balanced formation and development as well as economic, social, ecological and public important components of its development. Such clusters are necessary to form on the principles of the economic activity subjects integration located on adjacent regions territories which provide these subjects with additional priorities in comparison with their own functioning.
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