
Role of Agricultural Clusters in Provision of Food Security

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Abstract:

The article is devoted to determination of the role of agricultural clusters in provision of food security. The authors analyzed the statistics of The Global Food Security Index of 2014 in the developing and developed countries and found out that the problem of provision of food security is very urgent in developing countries, which necessitates the search for effective tools for increasing the food security, one of which is creation of agricultural clusters. For the purpose of solving this task, the authors offer the model of uniting manufacturers and processors of agricultural production into a system which allows determining the mechanisms of their organization into the system of agricultural cluster. The authors allocated the following main courses of the increase of the food security by means of development of agricultural complex, through formation of agricultural clusters: development of the sectors of agricultural cluster, implementation of deep specialization, attraction of young specialists into agricultural cluster, increasing the qualification of staff in agriculture and agricultural processing, stipulating the promotion and consumption of local production, creation of regional association for the increase of efficiency of cooperation between members, attraction of investments, cooperation with regional bodies of executive power and federal bodies of state power.

Key Words: *Agricultural Cluster, Food Security, Developed Countries, Agro-Industrial Complex*

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1. Introduction

The issue of food security escalates every year, as the population of the Earth grows and the climate situation aggravates. At present, the concept of cluster development is used as a key element of the strategies of socio-economic development and provision of food security of the leading countries of the world. Thus, in particular, Danish, Finnish, and Swedish industries are fully clustered. Particular clusters work successfully in Germany (chemistry and machine building), France (production of food and cosmetics), Singapore (petrochemicals), Japan (car industry), and other countries of the world.

In developing countries, there is an active discussion as to the possibility of use of cluster approach to the regulation of socio-economic development of regions. Unfortunately, as of now, cluster projects are not being implemented. However, the role of clusters in the development of regions is huge, as they are "growth points" of not only the region but of the whole national economy.

Cluster, as a territorial and sectorial form of organization of production (through deepening of cooperation between cluster members) stipulates the development of targeted programs for economy development. Cluster policy should be conducted in cooperation with the bodies of state and regional authorities, scientific and research organizations, educational establishments, and business – as only such combination of efforts can lead to a high level of socio-economic development.

Actuality of the study of agro-industrial clusters is confirmed by the growth of interest in the development of cooperation and creation of agro-industrial clusters (agricultural clusters) in various developed countries. The article offers a hypothesis that agricultural clusters stipulate the increase of food security in developing countries. This research is devoted to the verification of this hypothesis.

2. Materials and Methods

The idea of cluster approach became especially popular in the recent decade, though the foreign founders of the theory of clustering have been developing this sphere for quite some time, for the purpose of creation of mechanisms of industrial policy, aimed at provision of economic growth, competitiveness of enterprises and their production (services). The issues of cluster associations are reflected in the works of such famous researchers as [Garthwaite, K.A.](#), P.J. [Collins](#) and C.[Bambra, He, J., Jacknowitz, A.](#), T. [Morrissey](#) and A. [Brannegan, Maitra, C.](#) and [D.S.P.Rao](#). The statistics of The Global Food Security Index for 2014 in developed and developing countries is shown in Table 1.

Table 1. The Global Food Security Index 2014

Ranking	Country	Index
Developed countries		
1	USA	89.3
2	Austria	85.5
3	Netherlands	84.4
Developing countries		
3	Norway	84.4
33	Brazil	68.1
40	Russia	62.7
42	China	62.2
69	India	48.3

As is seen from Table 1, the problem of food security is especially urgent in developing countries, which necessitates the search for effective tools for increasing the food security, one of which is creation of agricultural clusters. For determining the role of agricultural clusters in provision of economic security of modern countries and regions, the following methods are used: methods of comparative and problem analysis, synthesis, induction, deduction, and analysis of statistical information.

At present, there is no single approach or method of evaluation of the level of food security. In one case, the provision of food security is viewed as sustainable development of agro-industrial complex, in the other – as a level of self-provision of population by food products (Chirkina and Ioda, 2012). In the international statistics, food security is measured by the level of calorific capacity of daily ration of the population. However, this indicator, as the other average statistical indicators, has some drawbacks. Firstly, each nation has its preferences in consumption of food products. Secondly, in order to understand the level of food security, it is important to take into account the differentiation of population as to the level of income per capita – as with allowable limits of average values, there can be a situation when significant layers of population will experience the lack of food (Chirkina, 2013).

Let us consider the foreign practice of evaluation of food security and study the experience of Japan, where such an indicator, as food self-sufficiency, has been used from 1950s (Zageeva, 2014). It is calculated as percentage ratio between the cost of created and consumed food products in Japan. Later, two more calculation methods were designed – on the basis of the energy level of food for population (in this case, the basic point is not the cost of produces and consumed food but its caloric value) and on the basis of so called initial calories (in this case, the quantity of calories in forage, necessary for animal production, is calculated) (Greshonkov & Abramova, 2014).

These methods for evaluation of the level of provision of food security do not allow taking into account the peculiarities of food security of developing countries (Moskovtsev & Lipatov, 2013). For the purpose of evaluation and measurement of the level of provision of food security, allocation of factors, which determine it, and of problems, which restrain its development, it is necessary – in our opinion – to use the methodology of complex evaluation of the level of food security which allows taking into account the whole variety of indicators and characteristics which reflect the state of food market and food security. According to the methodology, the level of food security (LFS) is calculated as a sum of scores as to the main criteria in the following formula:

$$\text{LFS} = P + E + S + Q + S$$

where:

- P – physical accessibility;
- E – economic accessibility;
- S – sufficiency of food consumption;
- Q – quality of food;
- S – sustainability of food system.

Each criterion has a certain level: 1 (high – the country is fully provided with its own production, the share of import does not exceed 10 - 15%), 2 (allowable – the country provides itself with its own production, the share of import does not exceed 30%), 3 (low – the country provides half of its demand, the rest is accounted for imported production), 4 (low-low – the country provides itself with its own production, but the share of import exceeds 50%). Summing up these levels, let us find the integral scores of the food security level. Consequently, high level of food security is granted the minimal score – 15. Allowable level - 16-30, low – 31-45, and low-low – 44-60. Thus, the integral evaluation of the level of food security provision has a complex information as to the state of each of its aspects.

3. Results and Discussion

Nowadays, it is obvious that cluster approach radically changes the principles of the state socio-economic policy, but requires the full reconstruction of the policy of state management, change of mentality of local authorities, another state of information on the state of economy – not as to levels, but at the level of particular markets and regions. Speaking about effective restructuring of former “agro-industrial giants”, it should be noted that it requires deep interconnection and cooperation between large and small business, authorities, universities, R&D establishments, etc.; here, cluster

approach forms the necessary analytical methodology and tools (Popkova and Tinyakova, 2013b).

Agricultural cluster has such features as close ties between its members, geographical concentration, innovational and educational direction, developed informational network, clear specialization inside cluster, etc. It is also possible to state that typical cluster includes the companies of small and medium sizes, each of which does not gain profit from competition with another company of the agricultural cluster, but has a possibility to use specialized resources. Speaking about territorial location of agricultural clusters, it should be noted that their limits are blurred and not strictly determined. Due to that, it is possible to allocate to following levels of territorial bodies ([Garthwaite et al., 2015](#)):

- productive & economic agricultural cluster;
- productive & infrastructural agricultural cluster;
- economic & agglomeration agricultural cluster.
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Agricultural cluster of productive & economic region is a localized cooperation of private farm households, farms, small enterprises, and agricultural organizations, oriented at innovational and diversification solution of socio-economic and ecological tasks of productive & economic activities, aimed at provision of economic development of a region and well-being of its population.

Agricultural cluster of productive & infrastructural region is a localized system of clusters of productive & economic regions, enterprises for processing of agricultural production, infrastructural organizations, R&D establishments, and universities which cooperate according to the principle of a cell model for the purpose of reduction of production cost, production realization, and socio-economic development of agricultural cluster of productive & infrastructural region on the whole.

Agricultural cluster of economic & agglomeration region is a systemic combination within natural & agglomeration region of cooperating clusters of production & infrastructural regions and non-production organizations, aimed at innovational & diversification development of production, education, science, and healthcare in the region and increase of food security of the country.

Agricultural clusters form and develop in the regions with natural and objective conditions for creation of this type of entities. They are characterized by ([He, 2015](#)):

- geographical localization. Scale of agricultural cluster may vary from a city to neighboring regions;

- cooperation of agricultural cluster enterprises – characterized by stability of economic connections and their dominating meaning for most of their members. At that, agricultural cluster includes enterprises of various spheres which are technologically connected and have specialization for manufacture of main and accompanying goods and services;
- innovational nature of agricultural clusters. They have a substantial capability for innovations, which can be explained by their members' possibility to quickly react to changes of buyers' demand, accessibility to new technologies inside agricultural cluster, cooperation in implementation of R&D works, and competitive pressure of market, which stimulates enterprises to create innovations.

Additional synergetic effects, received by cluster enterprises, are possible only if the interests and strategic priorities of agricultural cluster members are taken into account. With the help of specialization, which ensures the increase of labor efficiency and reduction of cost of produced goods, and with influence of three effects (scale, coverage, and synergy), non-profitable enterprises of agricultural cluster can overcome low limit of profitability. Thus, enterprises of agricultural cluster receive additional competitive advantages.

Agricultural clusters should be built according to the "bottom-up" scheme, i.e., the initiative of their creation should come not from bodies of federal or local authorities but from economic entities. At that, it should be taken into account that they should feature not only horizontal cooperation but vertical integration, as only complex cooperation can provide the synergetic effect for its members. This effect is reached by means of close cooperation of all interested subjects of agricultural cluster.

Combining fundamental science, R&D developments, and new high-tech productions, agricultural clusters create conditions for re-equipment of agricultural complex of region, stipulate the implementation of new technique and technologies, thus providing the development and sustainability of regional economy and leading to a completely new level of development - innovational. This requires performing the changes in preparation of staff (especially managing staff), attracting new specialists, and providing measures of state support for them (Popkova and Tinyakova, 2013a).

Integration of members of agricultural clusters optimizes activity for purchase of various equipment and equipment, allows implementing scientific & research and R&D developments, accumulating specialized information (knowledge), the access to which is organized in a better way and requires less expenses, simplifying the movement of information flows within agricultural clusters. At that, there remains complementarity of types of activities within agricultural clusters (services and consulting services, purchases, etc.), thus raising the quality and efficiency of work.

All of this leads to the increase of labor efficiency, reduction of cost of manufactured goods and services, and provision of effective development of production on the whole. Thus, cluster enterprises receive additional competitive advantages, which stipulates their subject's producing competitive goods and services which are in demand not in the region but also beyond it. This leads to the increase of internal turnover and, consequently, to the growth of tax base ([Maitra and Rao, 2015](#)).

Except for the above effects, there is also a multiplicative effect. It appears not only with main members of agricultural clusters but with enterprises of neighboring spheres and accompanying productions which form cluster infrastructure. This is caused primarily by territorial proximity of enterprises to key members of agricultural clusters, growth of investment attraction of agricultural cluster, presence of staff potential, development of its innovational processes, and level of socio-economic development.

These effects and interconnections can be presented in the form of a model of formation of cooperatives into the system of agricultural cluster. As was mentioned above, agricultural cluster should be based on the horizontal cooperation and vertical integration. It should be noted that scientific literature does not provide clear limits between cooperation and integration of agricultural producers, but we think that, from the position of organization of the processes in the agricultural cluster, "cooperation" and "integration" should be viewed separately ([Popkova et al., 2013](#)). For agricultural cluster, a necessary condition is formation of the system of agricultural cooperation of various levels. Thus, the first level of cooperatives are cooperatives with private farm households, peasant (farm) enterprise, small enterprises, and agricultural organizations which, uniting into cooperatives of the first level, cover agricultural production on the territory of one village, urban-type settlement, district, or region.

Second level is group of cooperatives of the first level which decided to have a joint venture for the purpose of provision of their member cooperatives of the first level with services, necessary for successful work. Organization of cooperatives of the first level and their entering the cooperatives of the second and further levels is the formation of the system of agricultural clusters. Entering a cooperative of the second level allows improving the indicators of activity of cooperatives of the first level through joint use of available resources – financial and material & technical. At that, a very important result is the growth of profitability of shareholders (cooperatives). During organizing the system of agricultural clusters, the cooperatives of the second level cooperate and unite their efforts not only with other cooperatives but with banks, insurance companies, state and regional establishments, R&D institutes, educational establishments, etc.

The goal of the first level cooperatives' entering the cooperatives of the second level is acquisition of services and information for the lowest prices and guaranteed realization of their production. Advantages of entering a cooperative of the second level are reflected in the functions it performs, namely ([Jacknowitz et al.](#), 2015):

- cooperative of the second level provides services in accounting of work of its members-cooperatives of the first level (accounting outsourcing);
- initial documentation is taken care of by employees of the first level cooperative, while all types of report documentation are formed by employees of the second level cooperative with consultations as to all accompanying questions;
- cooperatives of the second level provide their members the services for planning of their activities – they create production and financial plans, business plans of the first level cooperatives activities for short-term (up to 1 year) and long-term (up to 3-5 years) perspectives, business projects;
- positioning as a brand of high-quality, ecologically clean, and "domestic" production. This will allow attracting the attention of consumers of agricultural production and, correspondingly, increasing the competitiveness of agricultural cooperatives and raise the production of goods (services), for which the consumer is ready to pay. For members of cooperative of the second level, this will be reflected in the growth of the volume of realization of production and, correspondingly, of profitability of work and expansion of sales markets;
- informational provision of the members of the second level cooperative. This direction includes measures, seminars, and studies in main directions of activity of agricultural cooperatives, consultations, and creation of informational systems and portals.

In aggregate, all mentioned functions of cooperative of the second level give a possibility to see the unquestionable advantages of entering it, allowing the cooperatives of the first level to open the possibilities of development and increase of profitability of its work and the work of its members. Formation of regional system of agricultural cooperation will allow quickening the development of agro-industrial complex of the region and, correspondingly, will lead to improvement of conditions of life of the population of this territory by means of development of social infrastructure: creating new communications in countryside (gas, water, sewerage), opening new educational and healthcare establishments (hospitals, kindergartens, schools, training colleges, institutes' departments). As a result of improvement of conditions of life and provision of countryside population with work, the share of youth in the countryside will grow and the demographic situation in the region will improve.

While developing agricultural clusters, it is necessary to consider formation of agricultural cooperatives of the third level. Cooperatives of the third level will

include regional cooperatives of the second level, which will allow coordinating the management of cooperation at the regional level. Thus, cooperative of the third level will have an opportunity to provide informational and consultation services and support for its members (cooperatives of the second level) at various levels, which is a huge advantage for the work of cooperatives in the regions.

Together with the process of concentration of production on the basis of cooperation and integration, the coordination of interests of manufacturers of goods, enterprises of processing sphere, trade, and infrastructure is a main factor which determined the socio-economic direction and effectiveness of these processes. For agricultural manufacturers, these cooperative formations are most preferable, as they fully reflect their interests, allowing planning their production and incomes independently.

There are many examples when private capital, being initiator of organization of integrated formations, on the one hand, stipulates the revival of production, increase of employment, growth of income of particular members, and on the other hand, production subdues to private capital and its main task – gaining profit. Capital goes to the most profitable spheres, which does not always coincide with public interests. That's why the state should have a regulating role in combining public interests with the interests of the members of cooperation and integration. In particular, this can be achieved by creation of administrative state formations – regional economic associations – and preferential taxation, crediting, and use of other levers of state support.

Over many decades, the cooperation features liquidation of its democratic principles, ruining organizational structures, and subverting the goal and interests of economic activities of shareholders and cooperation employees. Expansion of command-and-control methods in agricultural cooperation led to elimination of its cooperative nature, and it was turned into a peculiar state department with only a sign of cooperation. These and other negative phenomena led to the destruction of the system of agricultural cooperation.

Cooperation has all initial means for overcoming stratification of society and unemployment. Activities of cooperatives should be aimed at elimination of unemployment, increase of living conditions of population, implementation of right for decent life; moreover, development of agricultural cluster in the region will allow “reviving life” in the country.

It is worth noting that developing countries has huge perspectives for the development of agro-industrial complex; however, there is a range of barriers which hinder its development. These are the following:

- limited access to main sales markets;

- low level of wages in agricultural organizations, which limits the possibility of attraction of highly-qualified staff and young specialists;
- insufficient cooperation of agricultural manufacturers with R&D establishments and universities of agricultural sphere;
- inaccessibility of loaned assets under profitable conditions (high interest rates);
- Imperfection of legal base in the sphere of cooperation and lack of it in the sphere of clustering.

4. Conclusion

Founding on the data of modern studies of the issue of formation of agricultural clusters in the region and on the results received during analysis and generalization of current foreign and domestic experience of creation of agricultural clusters, the authors include in the article the definitions of agricultural clusters of various levels of territorial entities (agricultural cluster of economic & agglomeration region, agricultural cluster of production & infrastructural region, agricultural cluster of production & economic region), which allows forming the cluster of regional level, for it to ensure:

- economic development of region;
- healthcare and welfare of its population;
- socio-economic and innovational & diversification development;
- increase of food security of the country.

Thus, as a result of conducted research, the offered hypothesis was proved; it was found that agricultural clusters have a very important role in the provision of economic security. It is possible to allocate to following main ways of improvement of food security by means of development of agricultural complex, through formation of agricultural clusters:

- development of sectors of agricultural clusters in crop farming and cattle breeding by means of implementation of deep specialization and modern technologies and increase of provision of members with high-quality seeds and breeding material;
- attraction of young specialists into agricultural cluster through providing measures of state support and implementation of effective mechanisms of motivation;

- increasing the qualification of staff in agriculture and agricultural processing, including by means of development of online study modes in educational establishments of higher and secondary vocational education;
- support for promotion and consumption of local production, including by means of creation of product supply chains within cluster, purchasing & sale and logistic organizations, and development of cluster production export;
- creation of regional association for increasing the efficiency of cooperation between members, attracting investments, cooperating with regional bodies of executive power and federal bodies of state power.

Formation of regional clusters is a new stage of provision of food security which supposes a high level of coordination of all its elements and market relations members' corresponding to the general context of regional development. For regional and local bodies of state power, cluster approach offers effective tools for realization of the programs of region's agro-industrial complex development, provides an opportunity to directly influence organizational and economic decisions, having the role of not an external pressing power but of an equal partner.

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