

# Development of the functioning mechanism of regional agro-food cluster «Volga Chickpea»

## Desarrollo del mecanismo de funcionamiento del clúster agroalimentario regional «Garbanzo del Volga»

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#### ABSTRACT:

Ensuring sustainable development of the grain legume enterprises and economically viable level of their market development in the context of import substitution is achievable mainly through improving grain legumes market regulation based on cluster based network organization. The article puts forward the hypothesis about the necessity to create and develop in the Volgograd Region the "Volga Chickpea" regional food chain for the production, processing and distribution of food products made of chickpea with high added value. Based on the numerical classification and hierarchical clustering of the largest grain legume producers in the Volgograd Region, the authors substantiate the concept of cluster based network organization of regional grain legumes market, which will take into account the economic and geographical as well as infrastructural and technological potential of the territory. Such organization will contribute to the conjugation of branch priorities in regional agrarian economy development due to minimization and offset of the negative impact of cluster formations. In consequence of the conducted research the authors conclude that the implementation of the designed long-term development strategy of grain legume based economy

#### RESUMEN:

Garantizar el desarrollo sostenible de las empresas de leguminosas de grano y el nivel económicamente viable de su desarrollo de mercado en el contexto de la sustitución de importaciones se puede lograr principalmente mejorando la regulación del mercado de leguminosas de grano en base a la organización de redes basada en clusters. El artículo plantea la hipótesis sobre la necesidad de crear y desarrollar en la región de Volgogrado la cadena alimentaria regional "garbanzo Volga" para la producción, procesamiento y distribución de productos alimenticios hechos de garbanzo con alto valor agregado. Con base en la clasificación numérica y la agrupación jerárquica de los productores de leguminosas de grano más grandes de la región de Volgogrado, los autores corroboran el concepto de organización de redes de racimo del mercado regional de leguminosas de grano, que tendrá en cuenta los aspectos económicos y geográficos, así como infraestructura y tecnología potencial del territorio. Dicha organización contribuirá a la conjugación de las prioridades de las sucursales en el desarrollo de la economía agraria regional debido a la minimización y compensación del impacto negativo de las formaciones de grupos. Como consecuencia de la investigación realizada, los autores

in the region will ensure coordination of market interaction, the formation of mutually beneficial economic relations between agrarian business actors in the course of implementation of state policy in agro-industrial complex and formulation of development strategy of the grain legume crops market.

**Keywords:** clustering, agri-food cluster, food subcluster, regional grain legumes market, import substitution, chickpea, food technologies of third generation

concluyen que la implementación de la estrategia de desarrollo a largo plazo diseñada de la economía basada en leguminosas de grano en la región asegurará la coordinación de la interacción del mercado, la formación de relaciones económicas mutuamente beneficiosas entre los actores del sector agrario en el curso de implementación de la política estatal en el complejo agroindustrial y formulación de la estrategia de desarrollo del mercado de cultivos de leguminosas de grano.

**Palabras clave:** agrupamiento, agrupamiento agroalimentario, subgrupo de alimentos, mercado regional de leguminosas de grano, sustitución de importaciones, garbanzo, tecnologías alimentarias de tercera generación

## 1. Introduction

Ensuring food security of the state is a critical indicator of the viability of nation's economic system. The achievement of the key criteria for food security, characterized by the average caloric intake and its structure, is complicated by the fact that a third of the world's population currently suffers from lack of calories, while more than half of the population is plagued by lack of proteins. The population's need for protein is ensured mainly through production of grain legume crops, characterized by high transportability, suitability for storage, and possibility to use both as food and feed for farm animals.

Due to the nutritional value, grain legume crops are recognized as part of "healthy food" and occupy one of the leading places in development of food technologies of the third generation. Their adaptive capability in terms of market development is driven by very strong demand for grain legume products in the world that allows speaking about the benefits of export orientation and possibilities of creation of fundamentally new functional products in order to implement the competitive potential of domestic agro-industrial complex, to provide the population with high calorie and high protein food, develop gustatory pleasures and food culture of the nation, as well as ensure nation's health maintenance.

The necessity of solving problems concerning import substitution makes us re-assess and predict changes in key socio-economic parameters of grain legume crops market development that predetermines the need for independent studies of this problem.

## 2. Materials and methods

In the course of development of theoretical aspects of formation and evolution of the grain legume crops market in the context of globalization and rationalization of market structures, the authors referred to number of works (Korolev, *et al.*, 2008; Miloserdov, 2014; Uschachev, 2016; Koshkarev, *et al.*, 2010; and Balashov, *et al.*, 2013), which have made significant contribution to the development of agri-food market regulation concepts in Russia.

Fundamental theoretical and methodological aspects of forming agricultural clusters in the mainstream of their classical interpretation, and taking into account the specifics of agricultural sectors were considered in the research of the authors such as Firsova, *et al.*, 2014; Partiw, *et al.*, 2014; Tsathlanova, *et al.*, 2015; Wolman & Hincapie, 2015; Popova, *et al.*, 2015; and others.

When justifying the objective laws of grain legume crops market development from the standpoint of improving its functioning efficiency, we relied on research of several authors, namely Ovchinnikov & Balashova, *et al.*, 2014; Ivanova, 2012; Kozenko & Ivanova, *et al.*, 2017.

The agricultural markets infrastructure formation and development including logistics, national and global trends of its evolution, and issues of agricultural production clustering of large infrastructure projects is considered by scientists such as Timofeeva, *et al.*, 2009; Ovchinnikov, *et al.*, 2015; Popadiuk, 2014; Korobeynikov, *et al.*, 2016; and others. But,

despite the large number of studies in this area, certain issues concerning the formation of regional development strategies and cluster based network organization of grain legume crops market still require in-depth scientific conceptualization.

Deepening the theoretical and methodological concepts of grain legume crops market development, and elaboration of practical recommendations to form the organizational and economic mechanism ensuring functioning of regional agro-food cluster "Volga Chickpeas" are based on scientific methodological principles providing the integrity and consistency of studies, as well as theoretical and applied significance of the obtained outcomes.

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### **3. Results and discussion**

Innovative, industrial, agricultural, and other clusters are actively formed in the context of import substitution and cluster policy pursued by the Russian Federation in its regions. A new milestone that sets the development pathways of territorial clusters of the agro-industrial profile became the Forecast for Scientific and Technological Development of the Agro-industrial Complex of the Russian Federation for the period of up to 2030, developed in 2017 by the Ministry of Agriculture of the Russian Federation, as well as Action plan for the development of science and technology policy in agro-industrial complex, which suggest drawing up a program for the creation and support of regional clusters of agro-industrial profile. In fact, agro-industrial clusters already exist in many regions of Russia, though given the specifics of grain legume crops production, and development trends of the general economic situation, it can be stated that in this area there are considerable reserves for further development.

The formation of adequate mechanisms of grain legume crops market regulation implies collaborative efforts of federal agencies, as well as regional and local governments to create framework conditions ensuring the integrity of the national market, protecting interests of its actors, providing legislative and financial support for the development of market infrastructure, and taking into account local specifics.

Grain legume economy of the Volgograd Region, which is one of Russia's largest producer of legumes (holding 7th place in the Russian Federation, and 3rd place in the South Federal District), plays a crucial role in the development of the domestic food market and extended reproduction within agro-industrial complex. The Volgograd market of grain legumes is characterized by typical global trends and patterns, including the deepening process of globalization, the increasing influence of the global economic cycles and international division of labor, variability in market conditions, sufficient market saturation amid poor market infrastructure, significant price distortions, and the high level of monopolization.

The performed grouping of the Russian Federation subjects in terms of grain and legume crops sales profitability shows that within eight years (2009-2016) the Volgograd Region (46.6-35.2%) along with 16 grain producing regions has been included in the group characterized by a high level of profitability, which is ranged from 30.1 to 60%. However, generalization of successful development practices of integrated units in grain legume crops economies of the Volgograd Region, which is represented by the combination of different elements of the technological chain, namely production-distribution; production-storage-distribution; and production-storage-processing-distribution, demonstrates the need for the development of an integrated strategic approach to the regional legume crops market development based on cluster network organization.

In the present research it is established that the further development of market infrastructure and improvement of grain legume crops competitiveness is impossible without implementing the following measures: timely providing management bodies at all levels with reliable information on supply and demand in the grain legume crops market, as well as its dissemination to relevant industrial and commercial structures; monitoring standardization and certification of the distributed grain legume products; promoting the sustainable management of federal and regional grain legume reserves; and sharing best managerial and technological practices.

The successful implementation of the set tasks in the context of import substitution requires

implementing the following measures:

- 1) providing significant coordination and system strengthening of marketing cooperation of the regional grain legume crops market with labor, finance, education and science-driven technology markets, as well as manufacturing, services, and consumption spheres;
- 2) changing in the structure of grain production through the optimization of the fodder-grain subcomplex and increasing the percentage of high-energy and grain legume crops to the volume of not less than 900 thousand hectares;
- 3) organizing manufacture of high-quality grain and competitive grain based food products through the development and implementation of marketing research and the development of interregional and international markets, insuring sustainable grain and grain-based products trading.

Generalization of theoretical bases and practical recommendations of international and domestic management ( ... *et al.*, 2015) allowed the authors to propose a cognitive model of strategic development of the regional grain legume crops market in the Volgograd Region, which included the following main blocks: *theoretical and methodological basis* (market-based mechanism, represented by the grain legume products demand and supply, which determined the pricing process); *structural model of grain legume crops market development* in the region in the context of international integration (a constructive role of combination of heterogeneous factors influencing the market development, the impact of the global and national food markets, society, grain crops-based products supply, differentiated according to the degree of processing in domestic agro-industrial complex, as well as the state of the markets of substitute products of non-agricultural origin); and *productive component*, which characterized the competitive advantage providing a sufficiently high level of consumption and food security of the country and the region.

Strategic goals of regional grain legume market development are identified by the authors as follows: ensuring food security in the region, improving the competitiveness of grain legume crops production in the world markets, developing the agricultural economy and market infrastructure, improving the business climate quality and efficiency of information support for grain legume crops market participants.

Taking into account the probable global technological changes and possible options for transforming the market performance, we have substantiated three core adaptation scenarios for the future development of the regional grain legume market in the Volgograd Region: "progressive", implying the accelerated integration into the global economy at the postindustrial stage; "moderate", involving a gradual increase of innovative development potential; and "inertial", aimed at preservation of current trends and practices (in the context of slow growth, the commodity orientation of agricultural economy, and its dependence on the external environment).

From the viewpoint of possible corrective actions, caused by the specifics of innovation in the agricultural sector and forming a "window of opportunity" of choosing the optimal grain legume market regulation tools, all suggested scenarios of possible development have been carefully analyzed. Possible deviations from predicted scenarios were projected on two axes: political and legal support measures, and the magnitude of potential financial, resource, and motivational support.

Despite the obvious complexity in the implementation, "progressive" scenario is the most promising, because the risks and damages caused by its delay will grow exponentially. The choice of the more moderate scenario will not allow regional agro-industrial complex to get out of technology trap neither by 2020, nor by more remote period. According to "progressive" scenario, the cost of regional budget for innovation activities will differ from that of "inertia" scenario by more than 40%, at that, providing the opportunity of reaching more substantial target indicators of development.

For the successful implementation of long-term marketing strategy, the authors have proposed and justified cluster based network model for the organization of the regional grain legume crops market, uniting regional cluster formations into the national scale interregional cluster, which includes:

- 1) common normative and methodical regulations on creating of functioning cluster forms with the definition of the goals and objectives of their activities taking into account territorial specifics and spatial localization;
- 2) recommended practices defining the interaction procedure between cluster participants, and multilateral documents on the joint functioning of cluster members, and their interaction with the elements of regional management system;
- 3) organizational and economic order of relations with the financial system institutions at endocluster and exocluster levels;
- 4) methods, algorithms, and techniques to monitor and assess clusters performance in the economic and social plane;
- 5) provisions for conjugation of the territorial and sectoral priorities in regional economic development, minimizing or compensating the negative effects caused by the focal-polar properties of cluster formations.

For a more complete and reliable assessment of the external environment on the implementation of development scenarios in the regional grain legume crops market of the Volgograd Region, PEST-analysis has been conducted revealing Political, Economic, Social, and Technological aspects of clustering. In consequence of the conducted PEST-analysis of macroregional market, it has been revealed that economic factors are the most significant ones and form a group of special risks. This group of risk factors includes rate of inflation, tax rates, interest rate, and price situation for grain legume production, as well as rise of prices for resources and means of production in the grain legume economy.

Increasing the success of cluster based network organization of regional grain legume crops market largely depends on its assessment. To this end, the authors conducted a cluster analysis of the 24 largest and the most cost-effective grain legume crops manufacturers in the Volgograd Region (Table 1).

**Table 1**  
Variance analysis of clustering of grain legume crops manufacturers  
in the Volgograd Region in terms of their competitiveness, 2016

Indicator	Intergroup dispersion	Number of degrees of freedom	Intragroup dispersion	Number of degrees of freedom	Significance F	Significance Point (p)
X1	14.21794	2	8.78206	21	16.99924	0.000041
X2	12.56078	2	10.53922	21	12.63390	0.000250
X3	14.74788	2	8.25212	21	18.76520	0.000021
X4	20.03406	2	2.96594	21	70.92432	0.000000
X5	17.56330	2	5.53670	21	33.92031	0.000000
X6	3.53464	2	19.56536	21	1.84325	0.050012

The identified clusters are technological specialization zones within which grain legume production systems will be developed and refined (Table. 2). These zones accumulate natural factors of competitive advantages of grain legume products. Therefore they should be considered as the basic natural precondition for the formation of competitive and efficient grain legume crops production zones that meet regional needs, generating sufficient

merchandise on hand and providing a high return on investment.

**Table 2**

Results of the clustering of grain legume producers in the Volgograd Region according to the level of their competitiveness

Cluster title depending on its competitiveness	Number of enterprises in the cluster	Groups of enterprises included in the cluster
High	2	CJSC "Gelio-Paks", LLC APF "Kuznetsovskaya"
Moderate	12	Collective Farm "Zavety Lenina", APS Stud Farm "Red October", APC Stud Farm "Romashkovsky", LLC "Sunny Country", PF Oleynikova N.N., LLC "Leader", APC "Temp", LLC "VAPK", LLC "Pioner-Agro", LLC "Rus", JSC "Delta-Agro", LLC "Kalachevsky"
Low	10	PE FF "Bessonov V.V.", FF "Germogenov A.V.", PE FF "Konnova L.N.", PE "Mkrtchyan S.V.", PE FF "Kudryavtsev N.N.", PE FF "Orlov, V.P.," PE FF "Kul'dyashev A.K.", LLC "Zimnyatskoye", PE FF "Gun'ko V.S.", LLC AH, "Fregat"

**Note:** **APF** - Association of Peasant Farms; **APC** - Agricultural Production Cooperative; **PF** - Peasant Farm; **PE** - Private Entrepreneur; **FF** - Family Farm; **AH** - Agricultural Holding

The research conducted on this subject over the period from 1985 to 2016 allowed selecting yield and crops concentration as criteria to allocate the respective zones and define their territorial-administrative borders (Table 3). The zone of competitive grain legume crops production in the region will include the areas which provide yields over 15 t/ha, namely Ol'khovsky, Ilovlinsky, Kletsky, Kalachevsky, Leninsky, Oktyabrsky, Kotovsky, and Gorodischensky districts. The level of profitability on the average in the zone will make up 60.3%.

**Table 3**

Zones of competitive and efficient grain legume crops production in the Volgograd Region

Zone of effective production (Districts)		Zone of competitive production (Districts)
Alekseevsky	Uryupinsky	Ilovlinsky
Yelansky	Seraphimovichsky	Kletsky
Kikvidzensky	Kotelnikovsky	Kotovsky
Kumylzhensky	Rudnyansky	Kalachevsky
Mikhailovsky	Surovichsky	Leninsky
Nekhaevsky	Frolovsky	Ol'khovsky
Novoanninsky	Chernyshkovsky	Oktyabr'sky
Novonikolaevsky	Zhirnovsky	Gorodishchensky

The main tool of state support of the grain legume complex of the Volgograd Region will become the payments per 1 ha, adjusted for yield and bonitet score. This will provide the rationale for each district yield, corresponding to competitive production. Such an approach will encourage improving productivity of land based on the implementation of innovation.

In order to enhance further the competitiveness of the regional grain legume crops market in the framework of the implementation of "progressive" development scenario, the most appropriate and acceptable tactic is the one based on scaling up production, reducing costs, as well as providing integration and cooperation of production.

Evidence from the LLC APF "Kuznetsovskaya", the authors have developed and tested the interaction scheme of private subsidiary farming and peasant farm enterprises of the Volgograd Region as part of the food subcluster of the rural settlement in the cluster structure of the regional grain legume market. The cluster structure is presented as a holistic system of agricultural entities, spatially concentrated in the territory of the settlement, which includes households, agricultural organizations, and peasant (farmer) households, as well as related local authorities, elements of the grain legume crops market structure, that are complementary to each other and interact with each other to produce and distribute grain legume products, improve efficiency, and strengthen competitive advantage of both individual participants and the cluster in general.

Operational measures for development coordination and strategy making of grain legume crops production in the subcluster of the Ilovinsky District have been based on the functional relationship and close cooperation among all levels of production and supply chain, that is seed growing → production → processing → logistics → market.

For an economic justification of subcluster functioning efficiency, flow process charts were developed and the comparative analysis of alternative options was performed for long-term development of the LLC APF "Kuznetsovskaya" based on the implementation of innovative production technologies of chickpea in combination with accurate soil treatment and the use of Russian produced farming equipment that was especially important in the context of import substitution. The proposed measures involve a significant increase (by factor of 6) in the efficiency of the agricultural economy in the medium term.

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## **4. Conclusion**

Thus, the results of the conducted studies confirm the proposed hypothesis concerning the ability of achieving the set goal. Increasing grain legume crops production and distribution rate, improving its quality and strengthening competitiveness in terms of import substitution can be achieved by improving strategic development processes of the grain legume crops market as well as the organizational and economic functioning mechanism of the regional agro-food cluster "Volga Chickpeas". This will allow new opportunities for achieving balance, coordination of interrelated managerial policy measures in grain legume crops sector, as well as sustainable regional economic growth.

When implementing innovative technologies into grain legume crops production and processing, in addition to meeting intraregional needs, our region will be able to successfully export the chickpeas to the Middle and Far East. At the same time, the interaction of the subcluster participants will allow achieving the following goals: to unite similar specialized agricultural organizations and create a single market space; unlock the competitive potential of regional agro-industrial complex; focus efforts on solving critical regional problems and ensure balanced nutrition of the population of the region in the context of import substitution; create fundamentally new therapeutic and preventive products for children, sports, and diet nutrition; improve functioning efficiency of regional food chains by creating deep processing and logistics links; facilitate targeted support of agricultural product producers and processors; as well as extend the distribution channels of regional products, the access of producers and consumers to larger markets and product range.

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