RESOURCE - SAVING IN THE INDUSTRIAL SECTOR OF THE REGION BASED ON THE MODEL OF SYSTEMATIC CLUSTERING SYNTHESIS

INTRODUCTION

Innovation economics with a high part of intellectual constituent represents the new-type economics, functioning on the base of integration and networking of enterprises' activities, because this model determines cross-industry collaboration between enterprises, as well as between different business activities. Taking into account the global experience, activation of innovative processes in economics and consequently creation of competitive advantages of economic systems of different levels (micro-, meso- and macrolevels) is ensured directly by creation and functioning of industrial cluster-type structures (ANISHCHIK, RUSETSKIY, TOLOCHKO, 2007).

One of the key aspects of arranging activities of the national innovation system (NIS) is maintenance and development of resource-saving innovation production plants. Resource-saving is usage of a range of methods, tools, means and factors ensuring a decrease in consumption of the resource base by production plants at manufacturing products and their further usage (IZMAILOVA, 2013).

The most effective means of solving resource-saving problems in plants of the industrial complex is resource-saving technologies allowing for significant saving of material, municipal and labor resources. Resource-saving technologies are considered from two perspectives: on the one hand - these are technologies increasing economy of a resource base of a plant, enhancing reliability and durability of production systems, improving quality of products manufactured, and on the other hand – it is a means of improving ecological safety of industrial plants and improving their environmental activity (GERASIMOV, MININA, VASILYEV, 2003; ASTAKHOV, DOBROVA, 2012).

The authors present in the research paper the results of a systematic clustering of industrial complexes of the region. The importance of the systematic clustering of regional economics is defined by the fact that the industrial clusters in the contemporary conditions, being “points of growth and regional development” are capable of improving innovative activity in terms of quality in constituent entities of the Russian Federation, by means of integrated, networking and systematic arrangement of cooperation between economic entities. Innovation cluster systems of the region are aimed at playing the main role in these processes.
MATERIALS AND METHODS

Glossary

Cluster – is a group of interrelated organizations (companies, corporations, universities, banks etc.) concentrated on a certain territory: suppliers of products, components and special services; infrastructure; scientific and research institutions; higher educational institutions and other organizations complementing each other and strengthening competitive advantages of separate companies and the cluster as a whole.

Recycling – is the process related to waste management for the purpose of ensuring waste reuse in the national economy and converting it into raw materials, energy, items and materials.

Resource-saving – is organizational, economic, technical, scientific, practical and informative activity, methods, processes, a set of organizational and technical measures and activities, which accompany all the stages of the object’s life-cycle and which are focused on sustainable use and saving of resources.

Industrial policy – a range of measures of governmental control of economic processes on the industrial and corporate levels, focused on stimulation of innovative activity, structural rearrangement of economics and economy growth.

Market – is a category of commodity economy, a range of economic relations based on regular exchange operations between goods (services) manufacturers and consumers.

Innovation – is a novelty implemented or being implemented, ensuring improvement of processes efficiency and (or) quality improvement of products, which are of high demand in the market.

Strategy – is a long-term qualitatively defined development direction of a company related to the sphere, means and form of its activity, system of relations inside the company, as well as the company position in the environment leading the company to its targets (MASLENNIKOV, KRYLOV, 2011).

Bibliographic survey on the issue of developing a synthesis model of systematic clustering of the regional industrial complex and creating a cluster alliance based on networking and innovative ecosystem of the region.

Clustering of the industrial complex still remains debatable. Though there is a number of foreign and local researches of this economic category, neither a scientifically-based model of cluster development, methods and principles of cluster control in terms of its competitiveness, nor a mechanism of controlling the processes of creating cluster structures have been created within the regional industrial policy (BELOTSERKOVSKAYA et al., 2017).

There are three main reasons of areal integration of market participants in the world practice of clustering for the purpose of developing resource-saving (MACDONALD, 1992):

- First – an opportunity of getting additional income from joint distribution of expenses on development and maintenance of common resources for the enterprises-cluster residents, improving the efficiency of used resources;
- Second – proximity of the cluster enterprises to each other ensures a lower cost and shorter time of delivery of the resources required for production;
- Third – concentration of innovation enterprises within the surrounding areas contributes to creation and diffusion of new knowledge, experience and skills as a unique resource.

In the opinion of famous economist M. Porter (1993), the first cause of areal integration of the industrial sector is in the development of enterprises’ competitiveness. Development of competitiveness makes less competitive companies leave the market and consequently contributes to appearance in the market of a pool of companies with high competitiveness, which by means of networking development transform into the dominating cluster of companies located in the surrounding areas. M. Porter (1993) thinks that the main characteristics of a cluster are as follows: maximum areal proximity; similar technologies; joint
raw materials base; similar innovations. The theme of resource-saving in the theory of M. Porter (1993) is described in the common resource base – its joint use, which helps to optimize the resource consumption and to reduce the expenses.

From the perspective of resource-saving, the model of synthesis of systematic clustering of the industrial complex has been reflected in other theories of cluster development. S. Macdonald (1992) pointed out the role of a resource constituent at export development by analyzing trade on local markets.

Contemporary theories of competitiveness development of cluster systems were developed by V.P. Feldman and D.B. Audretsch (1999). The advantage of his theory is that it is based on significant empirical researches of diversification forms of the industrial sector in different countries. The main principles of this theory are as follows – “diversification often complies with input-output matrix or availability of connections between industries, complexes, which are based on relations of raw materials supplies and products purchasing. Such connections are built on the principles of efficiency of using the raw material base and industrial production, and are aligned with the mechanisms leading to creation of clusters. Apart from that, the most effective and viable clusters are innovation clusters which are formed on the base of diversification” (FELDMAN, AUDRETSCH, 1999).

French researcher D. Soulie (1987) used the term “draw dies” (French “Filieres”) to describe the groups of technological sectors of the industry. Creation of draw dies from their point of view was explained by dependence of one industrial sector on another, in terms of technological level of development and the resources used in production. It follows that draw dies – is a narrower interpretation of a cluster, based on one of its parameters – the necessity of creating technological connections between the plants, industries and complexes for implementation of resource-saving policy (TOLENADO, 1978).

The cluster approach in terms of resource-saving is reflected in the research papers of Swedish theoretical scientists. In their opinion systematic clustering is formed on the base of national economics structure, more exactly on the analysis of networking of big transactional corporations. The basis of cluster formation is the thesis of V.P. Feldman and D.B. Audretsch (1999) “on development blocks”. For competitiveness development “it is necessary to have connections between the ability of one sector to develop and the ability of ensuring progress in another. This development needs to be performed step-by-step, within one industry related by resources with other industries, which will ensure the opportunity to win competitive advantages by validity of their usage”.

The attitude to cluster formation in the RF is ambiguous. There is a number of views that there is not a single classic cluster structure in the country, that would comply with the principles of their formation and functioning, and the actually existing clusters in the country’s economics - are not the clusters, but production complexes and units of interested entities (EDELEV, LYAPUNTSOVA, 2014). The difference of systematic clustering in Russia from European classic clusters is that clusters are formed in the RF “from the top” – their creator is the government (VALDAYTSEV, 2008). This approach to clustering is defined by the fact that cluster formation in the RF started in the early 2000, in conditions of not developed market and absence of network communication between the market participants. Consequently, the enterprises were not interested in creation of clusters, that is why the initiative was taken by the government (DRONOVA, 2013; POGODINA, SEDASH, 2014). Over 2000 cluster structures were created during five years, and the government provided these structures with the budget subsidies, realized under the cluster development programs (VERKHOVIN, KISELEV, 2009). The characteristics of the Russian clustering model is the domination of the centrist-type cluster core and gravitation in its arrangement to holding forms (GALIAKBEROVA, GALYAMOVA, MATVEEV, 2020). Almost all the clusters in the RF have a mixed holding structure.

Thus, the problem of the research is creation of a cluster alliance, which can become an effective mechanism of developing economic cooperation of enterprises – residents of a cluster. The object of the research is the process of creating a cluster alliance on the base of networking and innovation ecosystem of the region. The subject of the research is the cluster alliance of integrated industrial complexes of the region.
The goal of the research is: to develop a model of synthesis of systematic clustering of the industrial complex of the region and to create a cluster alliance based on networking and innovation ecosystem of the region, where clusters will have access to the required resource base, infrastructural and informative support.

The hypothesis of the research is an assumption that the offered directions of systematic clustering of the integrated industrial complexes of the region are able to improve the quality of innovative activities in the entities of the Russian Federation, by means of networking and systematic arrangement of cooperation between the economic entities.

RESULTS

The problem of developing a model of synthesis of systematic clustering of the regional industrial complex and creating a cluster alliance on the base of networking and innovative ecosystem of the region.

The Government of the Samara Region approved, as implementation of systematic clustering directions during the initial stages of creating clusters in the industrial sector, the regional target program “Improvement of the system of handling production waste and consumption and creation of a cluster of using secondary resources on the territory of the Samara Region for 2010-2012 and for the period up to 2020”, which was called a recycling program (IVANOVA, 2012). The main goal of the program is creation and implementation of activities focused on formation and development of the waste handling system of industrial enterprises, as well as their usage as secondary material resources in the industrial enterprises of the Samara Region.

In the authors’ opinion, the acceptance of this target recycling program in the Samara Region became the new stage of resource-saving and improving the efficiency of industrial enterprises activities. And it has conditions for successful development as certain cluster structures or recycling structures inside the cluster. Cluster approach became the most effective approach for accelerated development of the recycling sphere.

This program was developed for the period from 2010 to 2024, with implementation of the 2nd stage. During the 1st stage from 2010 to 2012 organizational and economic mechanisms of the program implementation were created and performed experiments on separate collection of solid waste in the enterprises of the Samara Region. Later this process was arrange in the populated areas of the regional municipalities. During the first stage, general schemes of cleaning the regional territory were also developed and created. During the next step design and construction of phase-one facilities of waste handling were performed on the leading plants of the region (LIPALINA, 2012; STROKOV, 2020).
On the second stage, from 2013 to 2020 a set of measures was implemented related to creation of plants for recycling of recoverable materials, and the places of unauthorized waste disposal were liquidated. Apart from that, the activities program was adjusted on the second stage, taking into account the results of implementing the program on the first stage.

The amount of financing of the target program was 8 billion 264 million 748,4 thousand rubles. The sources of financing the program activities were as follows: the budget of the Samara Region (expenditure commitments) – 4 billion 29 million 609,4 thousand rubles; local budgets - 190 million 497,2 rubles; extra-budgetary allocations – 4 billion 44 million 641,8 thousand rubles (MIROLYUBOVA, KARLINA, KOVALEVA, 2013). Financing of the program activities by the regional budget was performed also in the form of appropriations for payments under government contracts for supplies of goods (performance of works, rendering services) for governmental needs, and subsidies to local budgets.

**DISCUSSIONS AND CONCLUSION**

The problem of developing a model of synthesis of the systematic clustering of the regional industrial complex and creation of a cluster alliance on the base of networking and innovation ecosystem of the region.

The authors offer creating such an alliance on the base of networking or innovation ecosystem of the region. All clusters will have access to the required resource base, infrastructural and informative support. Cluster formations, or alliance of clusters of the industrial complex considered as an economic system, mostly contribute to optimization of production processes, validity of using the resource base and development of resource-saving of enterprises-the residents of clusters, based on their networking and cooperation agreements, but at the same time ensuring their independence (Figure 2).
Synthesis of the systematic clustering of the industrial complex shall be performed according to the four cluster types in the authors' opinion:

- object clusters, or the clusters which are the objects for production activity research;
- cluster as a process, representing the dynamics of production business-processes on creation of innovations and increasing added value;
- project clusters, representing certain types of integration of power and means for completion of a project task;
- environmental (areal, territorial, sectoral) clusters, their structure and the main designation of their activity is defined by the factors of their creation and the role in the economic system.

The authors offer development of resource-saving of the industrial enterprises on the base of a synthesis of the systematic clustering model of the industrial sector, using four types of clusters (table 1).

**Figure 2. Cluster system (alliance) of the region.**

**Source:** Search data.

**Table 1. Parameters of resource-saving of typical clusters in the model of clustering synthesis.**

| Characteristics                                | Content                                                                                                                                 |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Object clusters                               | Integration in clusters can be performed not only on the base of the plants, but also by combining economic resources required for production and combination of operating results of industrial enterprises included into the cluster (LEONOV, 2019). |
| Cluster as business-processes                 | All business processes represent production process and other processes, with the result of their functioning in achievement of commercial benefits or certain performance efficiency in the output. The basis of business processes is improvement of performance efficiency. In order to achieve this target, it is necessary to reduce production costs, in other words to increase resource-saving (KALYANOV, 2003). |
| Cluster as a project                          | When considering a cluster as a project, it is worth marking the following; (TELNOV, 2004): 1. All projects are focused on achievement of a commercial result, and resource-saving is an integral part of any project. 2. In conditions of economy modernization in the region, with the increase of innovations role, it is possible to consolidate resources on the base of project clusters. |
| Cluster as an independent territorial (sectoral) structure | The differential characteristics of resource-saving in this cluster are as follows (RASTVORTSEVA, CHEREPOVSKAYA, 2013): 1. Integration of industrial enterprises on surrounding territories for the purpose of reducing costs on development and delivery of resources, which allows for taking competitive positions at the market. 2. Clusters don’t have any institutional and procedural dependence on each other, and they have no joint management system - they combine only on economic principles, which makes the cluster enterprises optimize their activity, improve performance efficiency, reducing production costs. 3. Clusters, the same as territorial and industrial complexes, which used to be in planned economy, jointly use the resource base of regions, including of monopoly companies. 4. If clusters are considered as sectors or types of economic activities, then the questions of market coordination of regional economics can be solved via influencing the clusters. |

**Source:** Search data.
The authors underline in the research that all the above-mentioned aspects of resource-saving exist in the activities of regional industrial clusters. The model of systematic clustering synthesis is used by the authors for creation of a complex strategy, as a liaison between enterprises-the cluster residents and the cluster system as a whole, representing a combination, alliance, which can be the basis of the innovation infrastructure of the region. The following conclusions can be done based on the research:

1. Allocation of a separate enterprise for recycling industrial waste will improve the efficiency of using raw materials and will allow the enterprises - the cluster residents not to direct additional forces and resources for recycling of production waste.
2. Clustering of the industrial complex of the region - creation of a regional economic system, allowing for efficiency improvement of the region’s activity and resource-saving.
3. Creation of a recycling system based on the cluster allows for improvement of resource-saving of the regional industrial complex.
4. Allocation in the cluster of an individual enterprise for recycling of production waste allows for making better use of the cluster’s industrial potential.

**RECOMMENDATIONS**

Based on the systematic clustering synthesis, the authors suggest performing additional activities on resource-saving in the cluster by means of additional manufacturing of products and usage of resource-saving technologies, by arranging a separate enterprise for recycling of industrial waste of enterprises-the cluster residents. This production process can be implemented because the cluster enterprises are engaged in serial production of identical products, have identical production waste, consequently, a recycling enterprise will have constant stable capacity utilization. The research materials can be useful for Managers of industrial enterprises, Experts in the sphere of economics and management.

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Resumo
O objetivo da pesquisa é desenvolver um modelo de síntese de clustering sistemático do complexo industrial regional e propor uma ideia de criação de aliança de cluster baseada em redes e ecossistema de inovação da região, onde os clusters terão acesso à base de recursos necessária, infraestrutura e serviços de informação. Os autores oferecem orientações para uma agrupação sistemática dos complexos industriais integrados da região, que se definem pelo facto de os agrupamentos industriais nas condições contemporâneas, sendo "pontos de crescimento e desenvolvimento regional", serem capazes de potenciar a atividade inovadora em termos de qualidade, em entidades constituintes da Federação Russa, por meio de redes e arranjos sistemáticos de cooperação entre entidades económicas. Os materiais de pesquisa podem ser úteis para os gerentes de empresas industriais, especialistas na esfera da economia e da gestão.

Palavras-chave: Cluster. Reciclagem. Economia de recursos. Política industrial. Aliança de cluster.

Abstract
The purpose of the research is to develop a synthesis model of systematic clustering of the regional industrial complex and propose an idea of creating cluster alliance based on networking and innovation ecosystem of the region, where clusters will have access to the required resource base, infrastructure and information services. The authors offer directions of a systematic clustering of integrated industrial complexes of the region, which are defined by the fact that the industrial clusters in the contemporary conditions, being "points of growth and regional development" are capable of improving innovative activity in terms of quality in constituent entities of the Russian Federation, by means of networking and systematic arrangement of cooperation between economic entities. The research materials can be useful for the Managers of industrial enterprises, Experts in the sphere of economics and management.

Keywords: Cluster. Recycling. Resource-saving. Industrial policy. Cluster alliance.

Resumen
El propósito de la investigación es desarrollar un modelo de síntesis de clustering sistemático del complejo industrial regional y proponer una idea de crear una alianza de cluster basada en el ecosistema de networking e innovación de la región, donde los clusters tendrán acceso a la base de recursos, infraestructura y servicios de información requeridos. Los autores ofrecen direcciones de una agrupación sistemática de complejos industriales integrados de la región, que se definen por el hecho de que los clústeres industriales en las condiciones contemporáneas, al ser "puntos de crecimiento y desarrollo regional" son capaces de mejorar la actividad innovadora en términos de calidad en las entidades constituyentes de la Federación rusa, mediante la creación de redes y la disposición sistemática de cooperación entre entidades económicas. Los materiales de investigación pueden ser útiles para los gerentes de empresas industriales, expertos en la esfera de la economía y la gestión.

Palabras-clave: Clúster. Reciclaje. Economía de recursos. Política industrial. Alianza de clústeres.