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The article shows factual information illustrating the possibility of changing the configuration of a region's economy with the help of a cluster approach. The article also reveals the background for creating regional cluster programs and a gives a comparative analysis of innovation activity by example of the Siberian Federal District (Russia), considers the experience of high-tech clusters, strategies and instruments necessary for their implementation as well as the results obtained.

Innovation, Investments, Territorial Clusters, Interregional Cooperation

## 1. Background for implementing cluster programs for regional development

At the turn of the century the industrial model economic development was replaced by the innovative model. The branch-wise model controlling social and economic development doesn't suit any more the network structure characteristic for territorial clusters. If the sector has a network structure all its activities are interdependent thus creating a network regional agglomeration, it eventually has an impact on the changes in the configuration of the region's economics. It is obvious that the new economic management will require further social and economic development based on cluster approach.

Russian economists have started considering the cluster approach as an instrument for changing the regional economics configuration and a means to attract investors since 2003.

The Strategy of Cluster Policy adopted by the Russian Ministry of Economic Development in 2008 is an institutional basis for reforms in Russia. According to the Strategy of Regional Policy Development in Russian Federation (2009) zones of advances economic growth were defined. They were supposed to be the platform for territorial industrial clusters and unified productions strings resulting in products with high value added and contributing to economy of Russia's federal subjects.

The concept of *Strategy 2020* (2012) implies forming territorial clusters in various economic regions of Russia. Russian regions should develop innovations and become more flexible and less attached to sources of raw materials and centers of funds flow.

Therefore the change for the model of sustainable growth based on innovative development is emphasized, thus going from "stimulating innovations to innovation based growth' [1].

It should be noted that several clauses of the *Strategy 2020* have already become state programs. The Ministry of Economic Development has initiated the creation of Centers for Cluster Development since 2010. Such Centers are institutions initiated by regional executive bodies in order to encourage efficient cooperation between small and medium-sized enterprises, educational and research institutions, non-profit and non-government organizations, public authorities, local self-government bodies and investors so that to implement joint regional cluster programs. The authorities have a right to regulate the investment flow and to assess the investment efficiency.

Initially seven regions were chosen for state support: Saint Petersburg, Tatarstan, Perm Krai, Kaluga, Samara, Ulyanovsk and Tomsk Oblasts. The state granted a subsidy of

160 million rubles from federal budget and 50-60 million rubles from regional budgets on a competitive basis to stimulate small business by implementing Centers for Cluster Development.

In 2011 Astrakhan, Kurgan and Penza Oblasts as well as Bashkortostan Republic and the city of Moscow joined the program. Nowadays there is a Russian Cluster Observatory including all Russian Centers for Cluster Development [2].

There is a project ‘Concepts Of State Support For Territorial Clusters Up To 2018’ that promises them state co-financing for five years.

In 2012 the Ministry of Economic Development announced a competition to implement territorial clusters and to give a new impulse for the regional innovative development. First of all, it concerned implementation of hi-tech clusters in such fields as: pharmaceutics, biotechnologies, medical equipment, information technologies, etc.

Implementing cluster strategies into the general regional development strategy allows changing the configuration of Russian regional economics, increasing their competitiveness and leading to a new model of economic growth.

## 2. Cluster analysis methods for comparative analysis of regional innovative activity

The purpose of our research is to study the peculiarities of territorial cluster implementation aimed at innovative investment development of economics through the example of 12 West and East Siberian regions from Siberian Federal District.

Most of the Russian natural resources are extracted in this district: 85% of lead and platinum, 80% of coal, 71% of nickel, 69% of copper, 44% of silver, 40% of gold, 90% of natural gas, 70% of oil. According to the expert estimations the raw materials industries will be the main economic source for Siberia, especially oil and gas industry controlled by the State. Nevertheless, the part of business that is not related to natural resources (pharmaceutics, biotechnologies, electronic communications, provision of logistic services, etc.) will eventually grow. This idea is confirmed by the data obtained while ranging by the production volume the biggest not related to natural resources plants of the Siberian Federal District. It turned out that it’s possible to earn more in medical wholesale and air transportation (Novosibirsk Oblast), aeronautical engineering (Irkutsk Oblast), bridge engineering (Omsk Oblast) etc. than in oil and gas industry [3, p. 8].

It is impossible to implement regional development cluster programs without using modern tools aimed at the analysis of condition and the assessment of their innovative activity. So our aim was to prove the possibility to use cluster analysis methods to diagnose the regional innovative activity so that to clusterize them by their indicators taking into account the type of technological innovations and types of economic activity.

Our problem solving algorithm had three stages. At the first stage Euclidean distances between the chosen indicators were calculated. At the second stage we built a scale uniting regions by single bond, we calculated measures and standard variance. Finally, at the third stage a dendrogram representing spatial clusterization and a summary table reflecting the region belonging to a certain cluster were obtained.

We used the official statistic data of the Federal Statistic Service for 2005-2011 as information database [4-6].

The following social and economic indicators were considered: capital investment in enterprises, average monthly labor-related costs and average number of enterprises. The following indicators characterizing region’s innovative potential were taken into account: technological innovation costs, number of technological innovative enterprises, innovative production volume. We also analyzed the data according to the type of activity: mining

operations, manufacturing activity, electrical energy, gas and water production and distribution, communications, IT and computer engineering.

As a result of the cluster analysis of social and economic indicators the Siberian Federal District regions were divided into three clusters:

| Cluster 1 | Cluster 2 | Cluster 3 |
|---|---|---|
| Kemerovo Oblast | Tomsk Oblast | Altai Republic |
| Krasnoyarsk Krai | Omsk Oblast | Republic of Buryatia |
| | Irkutsk Oblast | Zabaykalsky Krai |
| | | Republic of Khakassia |
| | | Tyva Republic |
| | | Altai Republic |
| | | Novosibirsk Oblast |

The first cluster includes the regions having higher social and economical results (illustrated by the activity of mining operations). Therefore, the regions included into the third cluster have the lowest social and economic rating in this activity.

The cluster analysis of innovative activity level allowed to distinguish two clusters:

| Cluster 1 | Cluster 2 |
|---|---|
| Altai Krai | Altai Republic |
| Krasnoyarsk Krai | Republic of Buryatia |
| Irkutsk Oblast | Tyva Republic |
| Novosibirsk Oblast | Republic of Khakassia |
| Omsk Oblast | Zabaykalsky Krai |
| Tomsk Oblast | Kemerovo Oblast |

The regions included in the first cluster have higher rates for innovative activity than those included in the second cluster.

Further we analyzed social and economic rates and rates characteristic for innovative activity in the four above-mentioned activities. The results are shown in Summary Table 1.

**Table 1. Summary Table Of Ratings For Siberian Federal District Regions (Social And Economic Development And Level Of Innovative Activity)**

| Регионы | | Economic activities | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Mining operations | Manufacturing activity | Transport and communication | Financial activity | Real estate, lease, provision of services | Average value of rating in all economic activities | Innovative activity |
| | | Value of rating | Value of rating | Value of rating | Value of rating | Value of rating | | Average value of rating |
| Altai Republic | P1 | 11-12 | 11-12 | 11-12 | 12 | 12 | **11.7** | 12 |
| Republic of Buryatia | P2 | 6-8 | 9-10 | 9 | 7-8 | 8-9 | **8.3** | 6-7 |
| Tyva Republic | P3 | 11-12 | 11-12 | 11-12 | 11 | 10-11 | **11.2** | 10-11 |
| Republic of Khakassia | P4 | 9 | 6-8 | 10 | 10 | 10-11 | **9.3** | 10-11 |
| Altai Krai | P5 | 10 | 6-8 | 8 | 9 | 8-9 | **8.5** | 3-4 |
| Zabaykalsky Krai | P6 | 6-8 | 9-10 | 5-7 | 6 | 7 | **7.1** | 8-9 |
| Krasnoyarsk Krai | P7 | 1 | 1 | 1 | 3 | 1 | **1.6** | 3-4 |

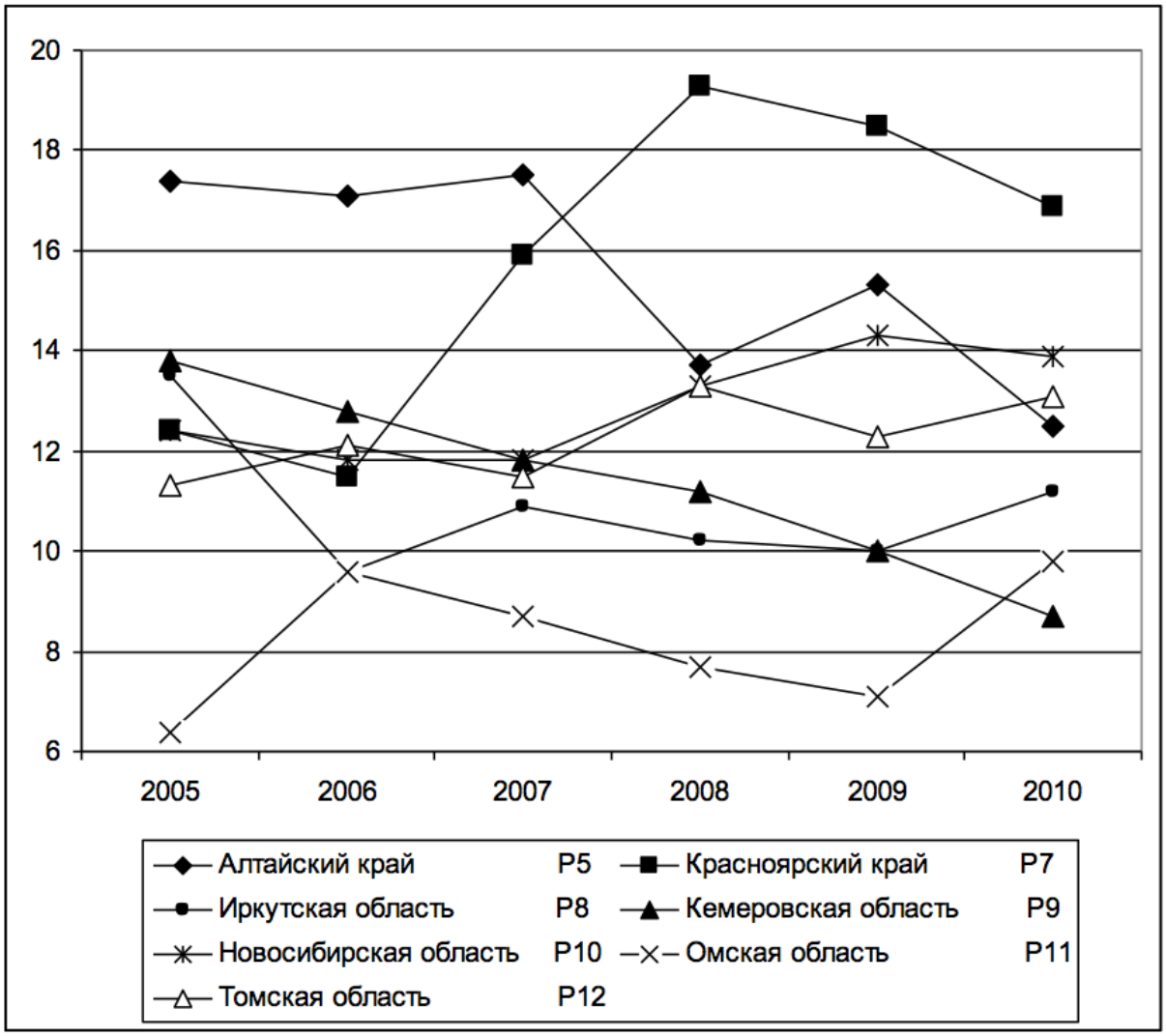
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Irkutsk Oblast | P8 | 3-4 | 3-4 | 3-4 | 2 | 3-5 | **3.3** | 6-7 |
| Kemerovo Oblast | P9 | 2 | 5 | 5-7 | 4-5 | 6 | **4.7** | 8-9 |
| Novosibirsk Oblast | P10 | 6-8 | 3-4 | 2 | 1 | 2 | **3.1** | 1-2 |
| Omsk Oblast | P11 | 5 | 2 | 5-7 | 4-5 | 3-5 | **4.9** | 5 |
| Tomsk Oblast | P12 | 3-4 | 6-8 | 3-4 | 7-8 | 3-5 | **4.6** | 1-2 |

The data in Table 1 show that the average value of the rating of social and economic indexes for each region can be compared to the rate of innovative activity. Altai Krai and Kemerovo Oblast make the only exceptions. So, in Altai Krai the average value of the rating of social and economic indexes is considerably lower than the rate of innovative activity. This fact indicates that the Altai Krai economy has a stable trend towards innovative type of development in spite of different regional specific types of economic activities. As for Kemerovo Oblast, the average value of the rating of social and economic indexes is considerably higher than the rate of innovative activity. It means that not enough attention is paid to innovations in the Oblast and there are no changes in the economy configuration in the post-crisis period.

Our assessment of Siberian Federal District innovative potential coincides with the official statistics in this field (Organization for Economic Cooperation and Development) [7, p. 216-218].

However, some regions usually active in innovation field have lately lost in the rate of development and have become less attractive for investors. As shown in Figure 1, we consider innovative 6 out of 12 regions of Siberian Federal District and Kemerovo Oblast. We observe that the innovative activity decreased the most in Altai Krai, Krasnoyarsk Krai and Kemerovo Oblast.

**Figure 1. Dynamics Of Innovative Activity For Siberian Federal District Technological Innovative Enterprises, %***




| | | | |
|---|---|---|---|
| Altai Krai | P5 | Krasnoyarsk Krai | P7 |
| Irkutsk Oblast | P8 | Kemerovo Oblast | P9 |
| Novosibirsk Oblast | P10 | Omsk Oblast | P11 |
| Tomsk Oblast | P12 | | |

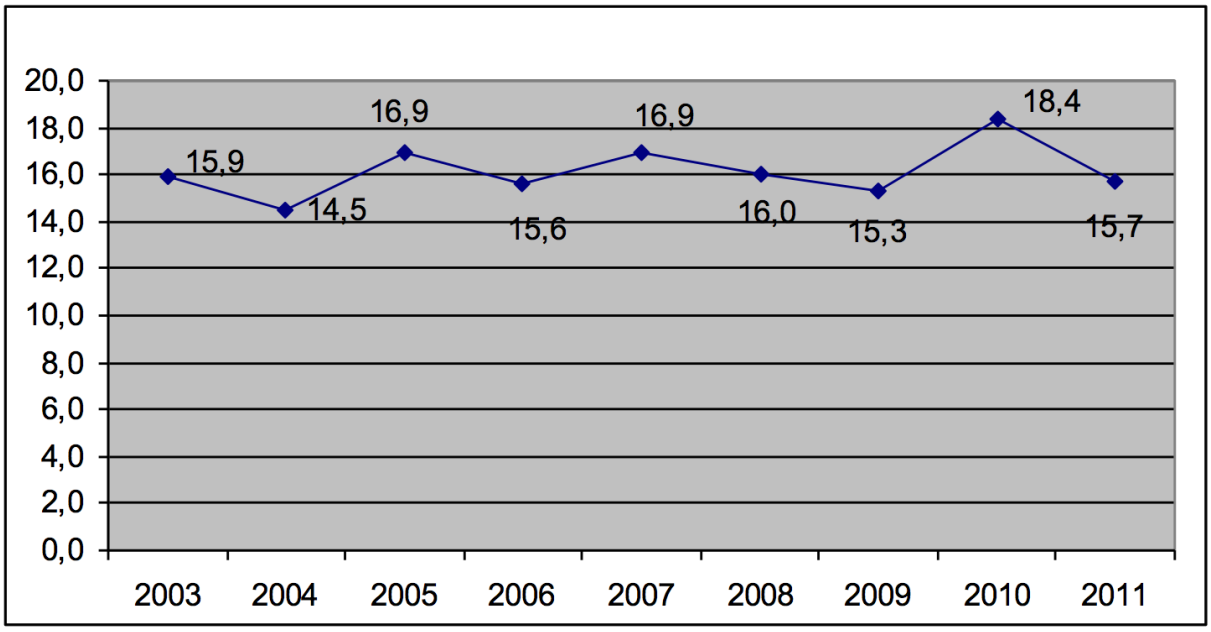
* Calculated according [5, p. 83; 6, p. 87], where P – order number of the region

The above-mentioned tendency is manifested in Tomsk Oblast, the fourth according to *Expert RA* rating agency Rating of Russian Regions with Greatest Innovative Potential.

According to the last statistics (shown in Figure 2) the number of active innovative enterprises decreased from 18.4% in 2010 to 15.7% in 2011 (or 48 out of 305 enterprises).

So the dynamics of innovative activities over the last years have a clear zigzagging trend which can not contribute to creating a new economy configuration. In other words, the process is irreversible for now.

**Figure 2. Fluctuation Of Specific Weight Of Innovative Enterprises In All The Tomsk Oblast Enterprises In 2003-2011, %***




*Calculated according to [8, p. 6; 9, p. 4; 10, p. 6; 11 p. 6; 12, p. 6]

The funding of innovative activities is quite irregular, which can be explained by the absence of long-term systematic financial provision for technological innovations in Siberian Federal District (Table 2).

**Table 2. Funding Sources for Innovative Enterprises in Siberian Federal District, %***

| Funding sources | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|
| Own funds | 73.1 | 74.0 | 69.2 | 85.1 | 76.0 | 78.3 |
| Federal budget | 4.4 | 4.0 | 4.8 | 2.6 | 4.5 | 14.1 |
| Budget of the subject of Russian Federation | 0.4 | 0.8 | 0.1 | 0.3 | … | 0.0 |
| Extra-budgetary funds | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 |
| Foreign investments | 0.0 | 0.0 | 0.0 | 0.0 | … | 0.1 |
| Other funds | 21.7 | 21.0 | 25.6 | 11.6 | 16.8 | 7.5 |
| ***Total costs*** | ***100*** | ***100*** | ***100*** | ***100*** | ***100*** | ***100*** |
| Including bank loans | 34.3 | 15.2 | 21.7 | 7.6 | 16.0 | 5.8 |

* Calculated according to [5, c. 92-95; 6, c. 109-112]
- no data available
0,0 – minor value

Foreign investments are mostly present in regions where natural resources are extracted (Tomsk, Kemerovo, Irkutsk Oblasts and Krasnoyarsk Krai). Their share being not very large in Siberian Federal District, their rates were not reflected in the table. There is an unfavorable tendency to decrease technological innovation expenses using bank loans to the minimum of 5.8% over the last period.

A comparative analysis of regional expenses on technological innovations shows a considerable differentiation both in dynamics over the years and in different regions.

Our research led us to the conclusion that it is necessary to take into account the region's specialization and the domineering type of innovations in order to develop good regional cluster programs.

The type of innovation depends on the industry branch type (traditional or hi-tech). Hi-tech branches are characterized by investment into educational sector and science and prevailing product investments. In traditional branches including oil and gas industry process innovation prevail as new hi-tech equipment is purchased.

We believe that on the whole process innovation expenses prevail in Siberian Federal District (Table 3). It can be explained by the fact that mining operation prevail in the regional economy.

**Table 3. Correlation Of Technological Innovation Cost According To Their Type In Different Regions Of Siberian Federal District In 2005-2010, %***

| Region | | Innovation Type | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Average value |
|---|---|---|---|---|---|---|---|---|---|
| ***Total in Siberian Federal District*** | | product | … | 29.1 | **50.9** | 40.7 | 32.7 | 32.5 | 32.6 |
| | | process | … | **70.9** | 49.1 | **59.3** | **67.3** | **67.5** | **67.4** |
| Altai Republic | P1 | product | … | **90.3** | **81.8** | 18.9 | **100** | **62.5** | **70.7** |
| | | process | … | 9.7 | 18.2 | **81.1** | - | 37.5 | 29.3 |
| Republic of Buryatia | P2 | product | … | 33.8 | **70.6** | **83.4** | 39.8 | **94.6** | **64.4** |
| | | process | 1.2 | **66.2** | 29.4 | 16.6 | **60.2** | 5.4 | 35.6 |
| Tyva Republic | P3 | product | - | - | - | - | - | - | - |
| | | process | - | - | - | - | **100** | **100** | **100** |
| Republic of Khakassia | P4 | product | … | 2.1 | 48.2 | 0.6 | 10.0 | 7.8 | 13.7 |
| | | process | … | **97.9** | **51.8** | **99.4** | **90.0** | **92.2** | **86.3** |
| Altai Krai | P5 | product | 40.3 | 41.6 | **62.6** | 31.1 | **59.4** | 32.7 | 44.6 |
| | | process | **59.7** | **58.4** | 37.4 | **68.9** | 40.6 | **67.3** | **55.4** |
| Zabaykalsky Krai | P6 | product | 3.4 | 11.6 | 39.5 | 2.8 | 0.4 | 15.7 | 12.3 |
| | | process | **96.6** | **88.4** | **60.5** | **97.2** | **99.6** | **84.3** | **87.7** |
| Krasnoyarsk Krai | P7 | product | 29.9 | 12.2 | 34.6 | 27.5 | 28.0 | 50.0 | 30.4 |
| | | process | **70.1** | **87.8** | **65.4** | **72.5** | **72.0** | 50.0 | **69.6** |
| Irkutsk Oblast | P8 | product | 12.6 | 13.1 | **51.1** | 14.6 | 36.1 | 18.0 | 24.3 |
| | | process | **87.4** | **86.9** | 48.9 | **85.4** | **63.9** | **82.0** | **75.7** |
| Kemerovo Oblast | P9 | product | 40.5 | 25.9 | **54.4** | **75.2** | **65.3** | 32.5 | 49.0 |
| | | process | **59.5** | **74.1** | 45.6 | 24.8 | 34.7 | **67.5** | **51.0** |
| Novosibirsk Oblast | P10 | product | **92.9** | **71.8** | **84.3** | **82.7** | **69.8** | **71.0** | **78.8** |
| | | process | 7.1 | 28.2 | 15.7 | 17.3 | 30.2 | 29.0 | 21.2 |
| Omsk Oblast | P11 | product | **63.7** | **63.3** | 46.5 | 29.8 | 15.1 | 12.0 | 38.4 |
| | | process | 36.3 | 36.7 | **53.5** | **70.2** | **84.9** | **88.0** | **61.6** |
| Tomsk Oblast | P12 | product | 26.8 | 29.7 | 40.1 | 48.1 | 13.7 | 40.2 | 33.1 |
| | | process | **73.2** | **70.3** | **59.9** | **51.9** | **86.3** | **59.8** | **66.9** |

*Calculated according to [5, p. 90; 6, p. 107-108]

… - no data available

Data empirical analysis resulted in distinguishing three groups of regions. The first group is represented by stable product innovation regions (Novosibirsk Oblast, Altai Republic, Republic of Buryatia). The second group is represented by process innovations (Tyva Republic, Republic of Khakassia, Altai, Krasnoyarsk and Zabaykalsky Krais, Irkutsk, Omsk and Tomsk Oblasts). The third is a mixed group where the ratio of product and process innovations is approximately 50:50 (Kemerovo Oblast).

We conclude that territorial clusters implementation requires taking into account the innovative potential along with the historically conditioned region's specialization.

# 3. Experience of implementing hi-tech clusters in siberian federal district

Regional clusters give a possibility to focus efforts and resources on priority directions using already existing technological platforms. Pharmaceutics and biotechnologies have become such directions in Siberian Federal District.

In October 2012 Russian State Duma approved the program of Russian pharmaceutical industry development based on cluster programs. The following leading territorial clusters were chosen: Moscow and Moscow Oblast, Saint Petersburg and Leningrad Oblast, Yaroslavl Oblast, Volgograd Oblast, Tatarstan Republic and some other regions.

Two regions in Siberian Federal District take part in this program. The first is a biopharmaceutical cluster in Altai Krai, *Ekvalar*, an enterprise using a complete cycle of production from medicinal herbs cultivation to herb extract processing and packing. Tomsk Oblast is represented by two big pharmaceutical enterprises *Pharmstandart-Tomskhimpharm* and *Virion*.

Tomsk Oblast is extremely interested in improving its image and attracting investments. So two regional projects were presented for a regional cluster competition organized by the Ministry of Economic Development. All Tomsk Universities, Research Institutes from the Siberian Branch of the Russian Academy of Sciences and Research Institutes of the Russian Academy of Medical Sciences created a technological platform *Medicine of the Future* in November 2011. So the project got a name 'Pharmaceutics and Medical Equipment'. It has become one of 13 winners of the competition out of 94 concurrent programs.

The second project presented by the Oblast government (for the program that doesn't get subsidized from federal budget) was supposed to implement an IT cluster. Later, a practical decision was made to unite efforts and resources in one cluster. The winning pharmaceutical cluster has become "Pharmaceutics, Medical Equipment and IT".

The winners of the competition are subsidized by the government for 5 years, each project receiving 2 billion rubles annually.

It is worth mentioning that by the end of the competition innovative clusters from Saint Petersburg, Novosibirsk and Tomsk were recommended to get together in a pilot project and unite their efforts.

Table 4 shows both existing and potential clusters from Siberian Federal District regions.

**Table 4. Territorial Innovative Clusters For Some Economic Regions Of Siberian Federal District**

| Regions | Clusters |
|---|---|
| Altai Krai | Agro-industrial, bio-pharmaceutical, tourist and health improving |
| Krasnoyarsk Krai | Solar power engineering, communication and navigation systems, oil and gas production, chemical industry, timber processing |
| Irkutsk Oblast | Nanotechnologies, oil and gas production, chemical industry, timber processing |
| Kemerovo Oblast | Coal-mining, metallurgical, coal chemical |
| Novosibirsk Oblast | instrument engineering, power electronics, biotechnological, IT-industry, nanotechnological, hi-tech agricultural |
| Omsk Oblast | Agro-industrial, bio-pharmaceutical, petrochemical, silicon |
| Tomsk Oblast | Pharmaceutical, medical equipment, information technologies, timber, solid-state microwave frequency electronics, fluoride technologies, West Siberian Nuclear Industrial Alliance, nanotechnological |

Studying the experience of cluster programs implementation in Siberian Federal District results in the following conclusions:

*Firstly*, the regions where mining operations (oil, gas, coal and other mineral resources) have priority and foreign investment rate is high and there is also a highly developed scientific complex and fundamental scientific schools, there is a tendency to modernize regional strategy and redirect in from mining operations to hi-tech sector (Tomsk Oblast, Altai Krai, Novosibirsk Oblast, Irkutsk Oblast, Krasnoyarsk Krai).

*Secondly*, if mining operations keep their domineering position, there are no changes in regional economy configuration, as innovative products and processes are only applied in one field (e.g. coal mining) and only branch science is developed.

*Thirdly*, new institutions are implemented to improve the region's innovative structure. For instance, Economic Development Agency in Tomsk Oblast and Regional Marketing Agency in Novosibirsk Oblast are responsible for projects within the region's innovative development strategy. Centers for Cluster Development search for foreign partners for exchange programs

within The President's Managerial Training Program. Tomsk innovative enterprises have partnerships with companies form the United Kingdom, South Korea, France, Germany and other countries [13].

*Fourthly*, the regional authorities support innovations to make the region more attractive for investments and to improve its image. For instance, Tomsk region has changed the concept of government from branch-wise administration model to program-aimed approach. So a new administrative structure was formed: there are 7 administrative clusters uniting branches and types of economic activity within departments of Tomsk Oblast government. There are such clusters as: traditional economy, new economy, infrastructure, investment, social policy, territorial development and management. There is also a working group responsible for cluster policy implementation.

The potential effect expected in Tomsk Oblast is as follows: firstly, the cluster will change the regional economy configuration; secondly, the cluster will get Russian pharmaceuticals to international level thanks to new product chains 'from molecule to product', corresponding to GMP standards. Nowadays only 50 out of 300 Russian pharmaceutical enterprises can follow GMP procedures.

All the above-stated leads us to the conclusion that territorial clusters implementation requires taking into account the region's social and economic historically conditioned specialization and the innovative potential along with the domineering type of innovations.

The clasterization we accomplished on the basis of our algorithm can be used for cluster policy implementing in other regions members of the same cluster.

Siberian Federal District Subjects have unequal economy configurations as the regional innovative system is not developed enough. It is urgent to develop cooperation, including interregional cooperation so that to improve the innovative activity.

Leading regions have underdeveloped innovative business and highly developed scientific and educative sector, which is the key problem for territorial cluster implementation. So the regions managing to provide efficient cooperation between Universities, science and business both in state and private partnerships will keep and strengthen their leading positions in Siberian Federal District and in Russia.

The experience shows that new regions sometimes join the hi-tech clusters, but the starting positions are rather difficult. We suppose that the cluster development programs will contribute to changing the economics configuration, promoting global growth and innovations in Siberian Federal District.

URL: http://2020strategy.ru/data/2012/03/14/1214585998/1itog.pdf (дата обращения: 31.10 2012).

Центры кластерного развития: Российская кластерная обсерватория: Национальный исследовательский университет "Высшая школа экономики" // http://cluster.hse.ru/centers (дата обращения: 31.10 2012).

Белоус А. На чем мы разбогатели // Городская газета. 28 июня 2012. С.8-9.

Федеральная служба государственной статистики [Электронный ресурс] // gks.ru: сервер Федеральной службы государственной статистики. 2011. URL: www.gks.ru (дата обращения: 15.05.2011).

Научная и инновационная деятельность регионов Сибирского федерального округа: Стат.сб. / Томск: Томскстат, 2010. - 130 с.

Научная и инновационная деятельность регионов Сибирского федерального округа: Стат.сб. / Томск: Томскстат, 2011. - 130 с.

Дегтерев Д.А., Стельмах А.В. Классификация моделей инновационного развития регионов: зарубежный опыт и российские реалии // Инновационное развитие и экономический рост: Мат-лы V Международной научной конференции. Москва, РУДН, 3 ноября 2011 г.- М.: РУДН, 2011. С. 213-218.

Инновации в Томской области за 2011 год: стат бюлл. / Томск: Томскстат, 2012. 91 с.
Развитие инновационной деятельности организаций Томской области: аналит. записка / Томск: Томскстат, 2007. 21 с.
Инновации в Томской области за 2008 год: стат бюлл. / Томск: Томскстат, 2009. 127 с.
Инновации в Томской области за 2009 год: стат бюлл. / Томск: Томскстат, 2010. 119 с.
Инновации в Томской области за 2010 год: стат бюлл. / Томск: Томскстат, 2011. 94 с.
URL: http://www.innoclusters.ru (дата обращения: 31.10 2012).