The cross-industry cluster formation as a reengineering mechanism for the production relations of the old-industrial regions

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Abstract. The article considers the formation of a strategic regional industrial policy in conditions of the new technological order occurrence on the basis of trends in the global technological development, conducts a strategic analysis of industry of the Republic of Bashkortostan on types of economic activities: mining, production of petroleum products, chemical production, manufacture of rubber and plastic products and construction, identified positive and negative trends and proposed future directions of development taking into account assumed scenarios of regional, national and global markets development. The study proposed options for the sectoral and cross-sectoral clusters establishment, the estimation of the resulting synergies in terms of creating inter-industry construction cluster based on the element wise estimation method of clustering efficiency and performed the benefits of the cross-sectoral cluster formation for all market participants.

1 Introduction

The basis of leadership in the modern world becomes a success in the technology markets. The forecast estimation of the Russian development for the upward stage period of the upcoming sixth "Kondratiev cycle" is calculated for two scenarios – inertial (GDP of Russia for the period is expected to grow by 2.2 times) and the innovative (growth of GDP by more than 9.5 times, and the average annual economic growth will exceed 9%) [1]. Synchronization methods of state innovation and industrial policy with the upward phase of a large cycle of conjuncture is able to give a synergistic effect and lead to significant and rapid increase in the welfare level of the population and the country as a whole.

In connection with the new technological order beginning the experts identify the following trends in global technological development: major technological innovations based on the use of new structural and composite materials created using nanotechnology, the formation of a new core of information technology on the basis of the transition from microelectronics to nanoelectronics, the alternative energy technologies development due to reducing the dependence on hydrocarbon energy resources [2,3].

The Russian development strategy cannot be implemented without synchronization with the strategy of regions. One of the most industrially-important regions is the Republic of Bashkortostan. In this case supporting technological initiatives will be the basis of the transition to a new technological level. The study proposes to assess synergy in the context of sectoral or cross-sectoral clusters based on element-by-element method of cluster creation estimation efficiency.

2 Strategic analysis

Republic of Bashkortostan is an old industrial region with elements of the fourth and fifth technological order. On its territory historically formed the concentration of industrial sectors [4], with its potential to increase production of high technology products through innovative transformation of its production complex in order to improve economic relations.

Strategic analysis of the economy of the Republic of Bashkortostan showed the presence of the following industries:

- mining;
- production of coke and petroleum products, chemical production;
- production of rubber and plastic products;
- construction.

Almost whole list of minerals is extracted on the territory of the Bashkortostan, which is available on the Russian territory. There are 194 deposits of mineral resources (without oil fields) at the state balance [5].

The largest share is oil and natural gas and mining of metal ores.

The analysis of indicators allows to make a conclusion about the ineffectiveness of a purely industry cluster mining, but there is potential for creating cross-sectoral clusters.

Refinery and petrochemical complex is the main source of economic and social development of

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Bashkortostan, occupies the first place in the Russian Federation by the volume of processed raw materials, produces half of the petrochemical industry products of the Ural economic region and accounts for about 40% of the industry profits. This complex is the largest Russian producer of a number of products, ranking first in production of butyl and isobutyl alcohols (50%); second place – in production of synthetic resins and plastics (15%); third place – in production of caustic soda (20%); sixth place – on polyethylene (11%) and synthetic rubbers (12%). More than seventy types of products are exported [6]. The share of chemicals and petrochemicals in total exports of the Republic is about 20%.

Table 1. Cross-sectoral clusters.

The type of mineral	The variant cluster
Production of bauxite and construction natural resources	Construction cluster
The extraction of copper, iron, manganese ore, precious metals	Automobile cluster, mining and metallurgical cluster
Oil and gas extracting	Fuel-energy cluster, petrochemical cluster
Peat extraction	Agricultural cluster, biochemical cluster

Positive and negative trends in the development of the enterprises for manufacture of coke and refined petroleum and chemical industries in the Republic of Bashkortostan are given in table 2.

Table 2. Positive and negative trends in the development of the enterprises for manufacture of coke and refined petroleum and chemical industries in the Republic of Bashkortostan

Positive trends	Negative trends
1 Labor productivity growth (28.6% for 2005-2013) 2 Exceeding average Russian «labor productivity» indicator in the Republic of Bashkortostan (13%in 2013) 3 The growth of investments in industry (for 23.2% in 2014) 4 Increase in the share of economic activity in the total investment in the Volga Federal district (from 17,1% to 17,9% in 2014) and Russian Federation (from 7,2% to 7,9%in 2014) 5 Leading positions in Russia: production of alcohols, butyl and isobutyl; soda ash; chemical plant protection products; soda; synthetic rubbers; synthetic resins and plastics; of polyethylene. 6 The only manufacturer in Russia of synthetic glycerin, perchloroethylene, ethylene-propylene rubber, baking soda	1 The slowdown in the growth of production volumes in monetary terms 2 The reduction in the volume of production in value terms in Russia (from 9.9% to 8.05% in 2013) 3 The reduction in the workforce (30% for2005-2014 or 14.8 thousand people).

One of the problems of the backwardness of petrochemical industry development in Russia – loss of vertical and horizontal integration. The reason for this is that the petrochemical industry as in the Republic of Bashkortostan and Russian Federation as a whole is structurally fragmented: regions of extraction and major centers of processing removed both geographically and divided by the ownership structure. The solution is to rebuild previously existing linkages between companies in the sector, which can be done by using the following approaches: the conclusion of mutually beneficial long-term agreements between participants, the creation of clusters, joint ventures.

Most popular products of the petrochemical industry at the present time are polymers (polyvinylchloride, polypropylene, polyethylene, etc.), which is primarily due to the mass transfer on plastic pipes, plastic building materials, as well as active usage of polymer packaging [6,7].

The main consumers of chemical and petrochemical products in Russia are the population, the enterprises of chemical and petrochemical industry deeper processing, as well as enterprises of mechanical engineering and the automotive industry, construction and agriculture.

Petrochemical products are in demand due to their high consumer characteristics. While in Russia there is a high untapped potential for growth in domestic consumption of petrochemical products (table 3).

Table 3. The comparison of the share of polymeric materials used in various industries in Russia and abroad, %

Industry	USA	Western Europe	Central Europe	Russia
Highway engineering	65	60	46	6
Pipe	75	70	40	15
Rooting material	70	47	38	3

It is estimated that Russia's current level of GDP per capita should consume 1.5-3 times more plastics than is consumed currently. The country needs to encourage domestic demand for petrochemical products due to changes and introduction of new national and supranational standards on consumers, the introduction of new requirements in the field of energy conservation and sustainability, involving the use of products with high technical characteristics and consumer properties.

The share of economic activity “Manufacture of rubber and plastic products” in the volume of manufacturing in Republic of Bashkortostan is 0.01%, Volga Federal district – 2,33%, Urals Federal district – 0,79%, Russian Federation – 1,83%. Industrial production Index of rubber and plastic products manufacture in 2013 decreased by 77.9% to 94.4 per cent respectively [7]. The decline in the production of rubber and plastic products is due to reduced orders for the automotive industry, rising prices for materials. Annual 30% growth in shipments until 2012changed to fall across Russia, but 2014 it was 7%, which exceeded the 6% growth in Russia and 1% in Volga Federal district.

There is a forecast for the change in the structure of consumption of plastic products in the long term to 2030 [8].All segments of the market related to the processing

of polymeric materials in Russia are developing dynamically for several years. Primarily this is due to steadily rising demand and a rapid return on investment. Investment attractiveness of the plastics processing sectors, especially for the enterprises of small and medium business, is due to the national economy development, economic activities consuming products from polymers such as construction, agriculture, production of vehicles and equipment, food production, and improvement of the business environment.

The increase in construction (annually more than 10%) [8] causes an increase in the demand for profiled molded and other products from polymeric materials. The structure of the Russian market capacity profile-molded products include 82-85% of products based on polyvinyl chloride, 10-12% of products from polystyrene, 5-6% of products from polyolefins. Market profile-molded products largely import-dependent, however, is developing towards an active import substitution. The share of domestic production in ensuring the demand of the domestic market has increased from 45% to 80% from 2007 to 2014.

The development of this sector is linked with the development of industries that consume products from polymers such as construction, agriculture, manufacture of transport equipment,food products.

The following main business segments production of plastics has been formed in the Russian market during the period from 2005 to 2014: packaging with a share of 30 – 40%, products and parts for production purposes — 15 – 18%, film – 16-17%, profile-molded products – 5 – 18%, products of cultural and household goods – 10 – 14%, pipes – 4 – 9%, leaves – 2 – 3% [7].

Table 4. Consumption sectors of rubber products.

Market	**Automobile industry**	**Mechanical engineering**	**Construction**
Market capacity, mln rub	881	3081	9676
Type of competition in the market	The average level of competition, a high level of concentration	The average level of competition, a high level of concentration	The high level of competition, a low level of concentration
Market share, %	0,04	0,10	0,13
Growth rate market share	1,05	1,01	1,10
Forecast market share	0,03	0,12	0,20

Industrial rubber products are used in almost all industries (table 4). In most cases, the reliability and durability of structures, machines or mechanisms are limited to the reliability and durability of components of rubber products, the contribution of which to the cost and weight of the machine or mechanism is usually negligible.

The main consumers of rubber are the automotive industry and agricultural machinery. The most significant growth in the production segment for construction is possible by the following products: gaskets, various coatings, isolation material, etc. One of the promising areas is the production of thermoplastic elastomers used in road construction. The use of such technology in the repair and construction of roads allows to increase the service life of pavement from two to three times and save gasoline due to more efficient coupling of tyres with road. In Russia less than 1% of the roads constructed using this technology, while in Scandinavian countries this figure reaches 25%.

According to the Russian Ministry of energy during the period of 2010-2020 reconstruction and construction of new roads (for implementation of the Transport strategy of the Russian Federation until 2020) would require the consumption of plastics of about 192 thousand tons, including 48 thousand tons of polypropylene geogrids and 144 thousand tons of geotextile from polypropylene and polyethylene terephthalate. In this case the existing power in Russia provides only 53 thousand tons of these materials, which requires the commissioning of new capacities [9].

Table 5. Consumption sectors of plastic products.

Market	**Packaging**	**Construction**	**Automobile industry**
Market capacity, mln rub	540	4345	176,2
Type of competition in the market	The average level of competition, a high level of concentration	The high level of competition, a low level of concentration	The average level of competition, a high level of concentration
Market share, %	0,80	21	8
Growth rate market share	1,2	1,03	1,02
Forecast market share	0,90	25	10

The construction sector is one of the interindustry economic complexes, which is a set of material production sectors and design activities to ensure the reproduction of fixed assets.

The result of the activity of the construction organizations is the creation or reproduction of fixed assets residential and nonresidential use.

There were 7 in 2013 and 11 in 2014construction companies of Bashkortostan in the list of 135best construction companies of Russia, that positively characterizes the quality of construction services in the Republic.

The Republic of Bashkortostan by the end of 2014 ranked 5th among the subjects of the Russian Federation for the commissioning of residential homes, 10th place for the amount of work performed by activity “Construction” and 12th place in terms of investment in fixed assets.

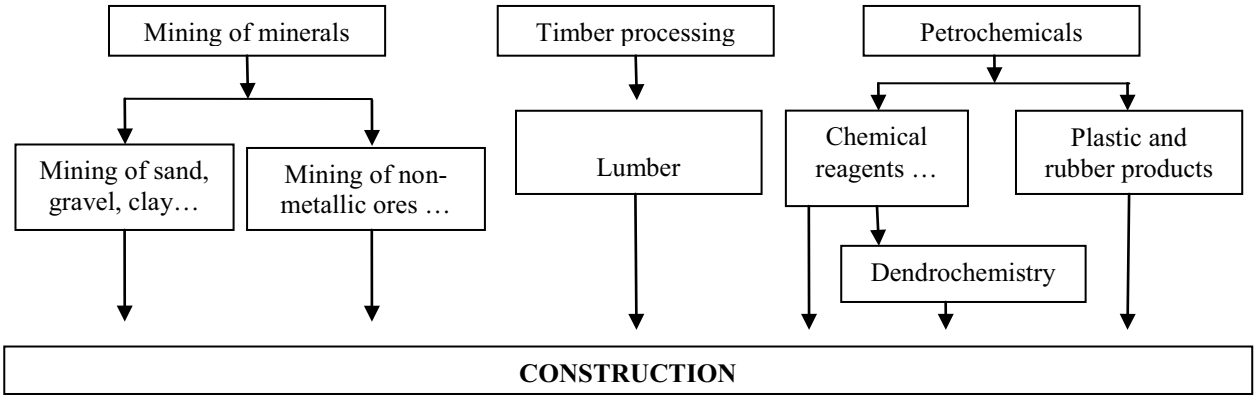

Fig.1. The common scheme of inter-sectoral linkages.

However, despite the high level of performance subject, the main problem of the sector remains a low industrial orders endowment.

The construction industry is one of the main consumers of products of other industries (figure 1).

It is needed to focus on the use of own mineral resource base, which will reduce the cost of new housing by reducing transportation costs of materials for development construction industry in the Republic of Bashkortostan.

3 Cluster formation

The analysis of economic activities in the Republic of Bashkortostan and the assessment of potential and priority directions of development in these industries enables it to identify opportunities for the formation of 2 types of cluster:

1. The petrochemical cluster. There is the Program "Development of petrochemical territorial cluster of the Republic of Bashkortostan" for 2014-2016 (app. the resolution of the Government of the Republic of Bashkortostan, dated December 9, 2014 No. 564) [10]. The effectiveness of this cluster is low. It is required to encourage the active cooperation of enterprises in the cluster and revision of instruments of administrative influence.

2. Cross-sectoral construction cluster (figure 2).

Effectiveness evaluation of the creating inter-industry cluster (construction, production of construction materials, development of new materials, structures and technologies of construction) is given in table 6.

The advantages of the cross-sectoral construction cluster:

- The ability to attract financial resources in the construction industry (Association of General financial capacity of the members of the cluster, attracting investment, joint participation in tenders of projects funded by the grant, cooperation of financial capabilities to provide guarantees for a loan).
- The possibility of reducing the cost of construction products and services of the organizations participating in the cluster.
- Having our own production based on local raw material stimulate reducing the cost of transportation, preservation, trading services, which reduces the cost of living area and repairs. Moreover, there are no problems with the sale: the product is completely used within a cluster.
- Association of organizations of the construction sector of the region allows the cluster members to effectively defend their interests at the level of the local government.

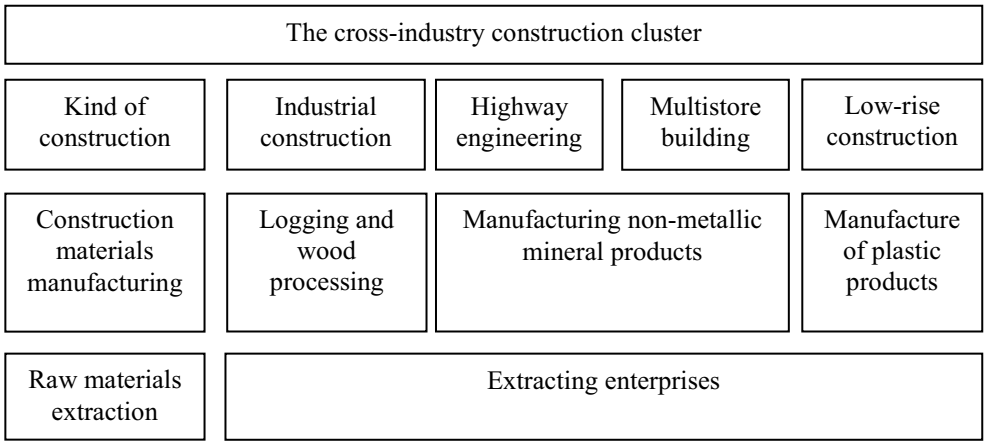

Fig 2. The cross-industry construction cluster.

- Realization the state programs of providing affordable and modern housing by members of the cluster is the provision of a constant workload of the construction industry and related sectors; creating new jobs; contributing to the revival of industry of certain districts with deposits of minerals used in construction.

Table 6. Effectiveness evaluation of the creating inter-industry cluster.

Evaluation criteria characteristics	**Coefficient of influence on the characteristic (Ki)**	**Amount of points (ki)**	**Evaluation of characteristics (Ni)**
1	2	3	4
1. The presence of competitive enterprises (N1)			
k1 – the determination of the current development potential of enterprises	0,4	10	9
k2 – the effect of cluster enterprises on the industry in the region	0,4	10	
k3 – the image of the cluster enterprises in the industry	0,2	5	
2. The implementation of innovative projects (N2)			
k4 – the degree of innovativeness of the industry	0,5	10	10
k5 – the commercialization of new technologies	0,5	10	
3. The growth of economic indicators of the industry (N3)			
k6 – the volume of works (services)	0,4	5	6,5
k7 – the number of people employed in the industry	0,3	5	
k8 – the volume of investments in fixed capital	0,3	10	
4. The linkages and interaction between members of the clusters (N4)			
k9 – the level of cooperation	0,4	10	8,5
k10 – the creation of the infrastructure necessary for cluster development	0,3	10	
k11 – the enter on new level of control	0,3	5	
5. Geographical proximity of cluster members, the right choice of cluster members and their number (N5)			
k12 – the geographical proximity of cluster members	0,5	10	7,5
k13 – the right choice of cluster members and their number	0,5	5	
Performance indicator of cross-sectoral cluster creating			8,3

- Association of organizations at the regional level – a new level of relations (new ways of thinking), which is based on honesty and trust between members of the cluster.
- The increase in innovative activity in the region. In this case, the benefit to the scientific organizations of the region is to expand the possibilities of introducing research results into practice.
- For financial institutions the creation of a cluster is the opportunity to participate in cluster projects in terms of the provision of funding under the large-scale investment projects.

The benefits of creating inter-industry construction cluster is the increase of budget revenues due to the growth in tax revenues, increase competitiveness and investment attractiveness of the region.

4 Conclusion

In the Republic of Bashkortostan there are objective opportunities for the creation of successful intersectoral construction cluster in the framework of strategic planning of sustainable territorial development of the subject. This cluster will allow to realize competitive advantages and development priorities involved in it industries with benefits for all participants, including improving affordability of housing for the population through the innovative materials and technologies using, which is going to reduce the cost of housing and to ensure the further development of the state programs supporting the population in acquiring housing.

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