Supporting Rationale of Regional Clusterization Effectiveness: Methodological Approach

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Abstract The paper deals with a study of cluster-type development of regional economic systems. Positive influence on the social and economic growth of a number of regions in the Russian Federation has been evaluated owing to generation of territorial cluster-type formations. The paper includes findings of an investigation into theoretical nature of «cluster» as an economic category. As an example of positive influence of the clusterization strategy, the project of formation and development of the regional cluster of Nizhnekamsk Municipal District of the Republic of Tatarstan has been offered and validated from economic effectiveness point of view. For the purpose of the project feasibility validation, a methodological approach has been specifically designed for evaluation of economic potential of the city-forming enterprises. During approbation, the above mentioned approach brought to the front a number of intensive growth prospects for the enterprises in question in the course of integration, and, consequently, viability of the regional cluster became worthy of notice. At the same time, the project in question was rationalized from economic effectiveness perspective. For this line of the investigation a special methodological approach has been developed so as to allow predicting a level of synergetic effect of the clusterization.

Keywords: cluster, integration, region, effectiveness, feasibility, economic potential, synergetic effect

1. Introduction

In the current environment competitive strength of a state represents a derivative feature of the competitive strength of all constituent territories of the state. This appears due to the fact that all resources, production factors, human and social capital as well as required infrastructure are concentrated at the regional level where specific economic entities operate. Today the global competition between countries comes down to the competition between specific regions. Regional economy is vested with the power of a driver of national growth. Such a situation signals the necessity of effective strategic regional development programs. The most advanced and innovative approach to development of a region under the present economic conditions is the clusterization approach. Efficiency of the clusterization strategy is confirmed by the extensive positive experience in the clusterization of many well-developed global economies.

Russia recently has been witnessing the heightening recognition of significance of the clusterization approach with respect to addressing the issues relating to modernization and technological sophistication of the national economic system as well as employment of institutional structures to serve as a support for innovative activities. However, the Russian regions – although they try to make the best use of advantages of the clusterization strategy – are still being at an early stage whilst experiencing the stage of adaptation of the clusterization policy to the specific features of the Russian governmental power functioning scheme as well as operation of science, education, business and society as a whole.

Therefore, analysis-based reasoning of practicability of the clusterization on the basis of the enterprises running in different regions of the Russian Federation, creation of reasoned suggestions and prediction of efficiency of such integrated formations represent the important tasks for the modern economy as well as a vital issue for a study.

2. Review of the Theory

In the recent years, a surge in interest to the clusterization strategies of economic development has been noted among the Russian scientists. This issue has been studied by A.V. Yermishina, G.F. Kasymov, G.S. Merzlikina, N.I. Larina, L.S. Markov, L.V. Yakimova etc. While there are a great many of research papers dealing with various aspects of clusterization processes, one can state that the nature of such cluster-type network formations has been insufficiently investigated. Therefore, it is worthwhile that in the course of investigation the theoretical nature of «cluster» as an economic category could be revealed.

Experts from the Organization for Economic Co-operation and Development (OECD) fairly noted that it had not been for no reason that the clusterization concept emerged. Theoretical roots of the clusterization concept can be clearly made out in the theory of comparative advantages developed by D. Ricardo as far back as the early 19th century. However, more frequently the well-known research paper «Principles of Economics» written by A. Marshall in 1890-1891 has been called by the specialists as a later theoretical source of the clusterization concept. In this study A. Marshall set forth the reasons for concentrations of small and mid-size businesses within industrial areas [7].

The notion «cluster» in the Western science and research publications was introduced into the economic theory by Mr Michael Porter, Professor of Harvard Business School and the author of the theory of competitive advantages. In 1990, M. Porter issued an 855-page paper «Competitive Advantage of Nations» [8] covering industrial structure of well-developed economies and development of leading global industries. M. Porter had ventured to carry out an investigation of the most well-being businesses in the world. He found out that certain companies from one or more countries more or less regularly demonstrated far better commercial achievements than their peers. This fact triggered off the theory of industrial clusters.

Studies of the conceptual framework of the economic theory under investigation helped work out the most generalized definition: a cluster represents a group of geographically localized interrelated companies–suppliers of equipment, OEM components, specialized services and infrastructure together with R&D institutes, higher education schools and other organizations mutually reinforcing each other whilst strengthening competitive abilities of the members of the cluster and the cluster itself.

Interaction between the enterprises and organizations making part of the cluster represents a combination of co-operation and competition processes. Within a particular integrated formation a continuous interchange of human resources, innovations, and technologies can be observed. Furthermore, shared use of infrastructural elements and services as well as advertising and promotional activities there can be seen. A cluster may comprise a large or small number of enterprises as well as a number of big and small-size businesses in various proportions. The main objective of cluster-type business model implementation is to change the mindset of the entrepreneurs whilst achieving their understanding of how to build honest, open and mutually beneficial co-operation between all members of the clustered formation for the sake of gaining common economic benefits. A significant peculiar feature of a cluster is its innovative orientation. Clusters generally appear in the locations where a break-through in the sphere of processes and technology is anticipated or taking place, with further penetration of the involved enterprises into new market niches.

3. Methodology

Application of the clusterization approach as a key mechanism of strategic development of involved territories has given rise to the issues relating to reasonability of specific clustered units formation. In this context we developed our own methodological approach to validation of clusterization, which is based on the concept that growth prospects of an enterprise could be outlined using such an integral factor as economic potential. Growth prospects of integrated businesses, in their turn, allow evaluating opportunities for development of a cluster as a whole, and consequently validate formation of a cluster. This paper includes assessment of economic potential of a particular enterprise based on quick evaluation of its production, financial and market performance indicators. As a result of such assessment, one of the three possible rating positions may be assigned to the enterprise in question (A – high rating, B – average rating, C – poor rating).

Origination of a cluster-type formation is impossible without a preliminary reasoning of its economic effectiveness. Therefore, proceeding from recent publications dealing with this issue [2,3,4], we developed a methodology for prediction of a level of synergetic effect of clusterization. Using this methodology the authors of this paper suggest that a benefit from the synergetic effect should be evaluated based on the indicators of operation, financial and investment synergy.

A projected increase in the net cash flow represents the operation synergy indicator (SO). This is due to the fact that formation of a cluster helps achieving cost savings on running costs. In this case the operation synergy effect is defined as an addition to the net cash flow and determined using the formula below (1):

$$S_O = \sum_{i=1}^{n} CF_i \times S - \sum_{i=1}^{n} CF_i \qquad (1)$$

where CFi – net cash flow on investments of the integrated enterprise; S – synergy coefficient.

The financial synergy indicator (SF) is calculated based on the projected addition to cluster revenues resulting from enhanced financial potential of the enterprises. This indicator is determined using the formula below (2):

$$S_F = \sum_{i=1}^{n} R_i \times S - \sum_{i=1}^{n} R_i \qquad (2)$$

where Ri – revenues from sales of products (supply of services / performance works) of the integrated enterprise; S – synergy coefficient.

It is appropriate that the investment synergy indicator (SI) shall be regarded as an addition to the cost of equity of the enterprises making part of the integrated formation, which is driven by maximization of return on investments by way of using cumulative factors and concentration of production facilities as well as involvement of additional investments. This indicator is determined using the formula below (3):

$$S_I = \sum_{i=1}^{n} E_i \times S - \sum_{i=1}^{n} E_i \qquad (3)$$

where Ei – an amount of equity of the integrated enterprise; S – synergy coefficient.

For calculation of the indicators of operation, financial and investment synergy it would be required to determine the synergy coefficient (S) which serves to reflect the rates of economic efficiency growth of the integrated

enterprises as a result of the integration and interaction of the enterprises within the cluster. The value of this coefficient is suggested to be determined using the formula below (4) based on the integral indicator of economic potential a calculation method for which has been described above:

$$S = \prod_{i=1}^{n} (EP)_i \qquad (4)$$

where (EP) – coefficient of economic potential of the integrated enterprise.

This coefficient can have the following values:

- [EP (A)] = 1.5 for high degree of economic potential;
- [EP (B)] = 1.1 for average degree of economic potential;
- [EP (C)] = 0.5 for low degree of economic potential.

An overall amount of the synergetic effect (SE) of origination and operation of a cluster is determined in general as a sum of the operation synergy indicator (SO), investment synergy indicator (SI) and financial synergy indicator (SF) using the formula below (5):

$$SE = S_O + S_F + S_I \qquad (5)$$

The above described methodological approaches were approbated in the course of validation of formation and development of the regional cluster of Nizhnekamsk Municipal District of the Republic of Tatarstan.

4. Research Findings

With a view to support the clusterization effectiveness we simulated the regional cluster represented by Nizhnekamsk Municipal District of the Republic of Tatarstan which is supposed to be formed on the basis of the major petrochemical and oil refining enterprises, namely, TAIF-NK PSC, Nizhnekamskneftekhim OJSC, Nizhnekamskshina OJSC, and TANECO OJSC.

All the above mentioned enterprises have been successfully interacting since the late 20th century, and such an interaction is first of all due to the continuity of the production and technological chains. However, the integration processes taking place within the petrochemical complex of the Republic of Tatarstan, in particular, consolidation of Nizhnekamskneftekhim OJSC with TAIF Group as well as consolidation of Nizhnekamskshina OJSC with Tatneft OJSC, have made

an impact on their interaction resulting in a weaker co-operation between them on the Nizhnekamsk industrial site because of appearance of new clients, alternative sources of feedstock and raw materials. At the same time, the competition between TAIF and Tatneft has toughened in terms of motor gasoline supplies to the Nizhnekamsk fuel market. An official formation of a cluster in Nizhnekamsk Municipal District would contribute to strengthening of the previously existing vertical integration links within the production and technological chains as well as help build up horizontal integration for the purpose of production diversification.

For experimental approbation of the developed methodological approach to the clusterization validation, an evaluation of economic potential of the city-forming enterprises of Nizhnekamsk Municipal District of the Republic of Tatarstan has been carried out. The evaluation results are shown in table 1 – table 3 and figure 1 below. The following conclusion has been made: TAIF-NK and Nizhnekamskneftekhim have the high rating (A) of economic potential. These enterprises are capable to become a driver for economic development of the cluster. TANECO, in its turn, has an average rating (B) of economic potential, though being of particular importance for the cluster owing to the fact that TANECO represents a large-scale project involving construction and commissioning of oil refining facilities. Implementation of this project may have a sizable impact on development of the cluster in a long-term outlook. As far as Nizhnekamskshina OJSC is concerned, this company has the poor rating (C) of economic potential, however, featuring a high level of production potential. The enterprise is able to produce large volumes of marketable tire products, which makes Nizhnekamskshina attractive for the cluster. Optimization of the operation and financial performance of Nizhnekamskshina could be achieved by maintaining unified marketing and sales policy within the cluster as well as by using the effects of scale, experience and coverage.

Thus, the conducted practical study helped identify a number of favorable conditions, with making a conclusion that formation of the regional cluster represented by Nizhnekamsk Municipal District can be regarded as a validated and practicable suggestion since this integrated structure demonstrates a good potential for intensive economic growth.

Table 1. Production potential indicators of the enterprises running in Nizhnekamsk Municipal District of the Republic of Tatarstan (2010 – 2013)

Indicators / Enterprises	Change in return on assets over the period under review	Change in return on materials over the period under review	Change in output over the period under review
TAIF-NK PSC	1,09 (B)	0,99 (B)	1,29 (A)
Nizhnekamskneftekhim OJSC	0,9 (B)	0,98 (B)	1,28 (A)
Nizhnekamskshina OJSC	1,56 (A)	0,9 (B)	3,83 (A)
TANECO OJSC	0,04 (C)	1,3 (A)	5,47 (A)

Table 2. Financial potential indicators of the enterprises running in Nizhnekamsk Municipal District of the Republic of Tatarstan (2010 – 2013)

Indicators / Enterprises	Financial independence coefficient*	Overall liquidity coefficient*	Return on total assets*, %
TAIF-NK PSC	0,55 (A)	1,24 (B)	21,49 (A)
Nizhnekamskneftekhim OJSC	0,7 (A)	1,33 (B)	15,065 (A)
Nizhnekamskshina OJSC	0,085 (C)	0,51 (C)	- 0,91 (C)
TANECO OJSC	0,0065 (C)	0,074 (C)	0,16 (C)

* Average value of the indicator over the period under review

Table 3. Market potential indicators of the enterprises running in Nizhnekamsk Municipal District of the Republic of Tatarstan (2010 – 2013), points

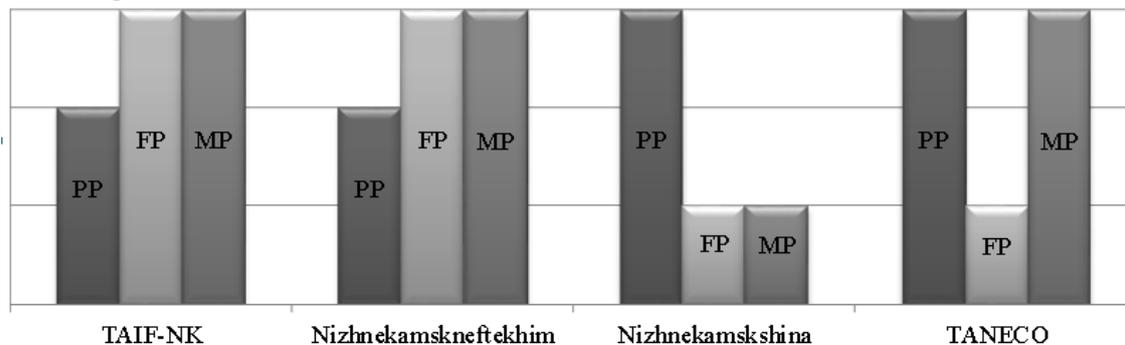| Indicators / Enterprises	Market standing	Product competitiveness	Market potency
TAIF-NK PSC	7	9	8
Nizhnekamskneftekhim OJSC	8	8	7
Nizhnekamskshina OJSC	5	3	2
TANECO OJSC	6	8	8

Figure 1. Levels of economic potential constituents assessed for the investigated enterprises, 2010 – 2013

It is worth noting that the clusterization process is sporadic by nature featuring a capacity for self-organization, absence of formal (legal) framework for integration, and full independence of the entities being members of the clustered structure. However, many countries recently have been witnessing appearance of the so-called «cluster-based initiatives» representing the process of searches conducted by the clustered structure initiators, which are aimed at finding mutually beneficial platforms for co-operation and interaction.

Such «cluster-based initiatives» best of all could contribute to organization of the activities and centralization of control over the integrated formation herein suggested for origination. In order to assure effective interaction between the municipal district administration and all members of the cluster, it would be advisable to create a coordination center (Board of the Cluster). A potential structure of a regional cluster is displayed in figure 2 below.
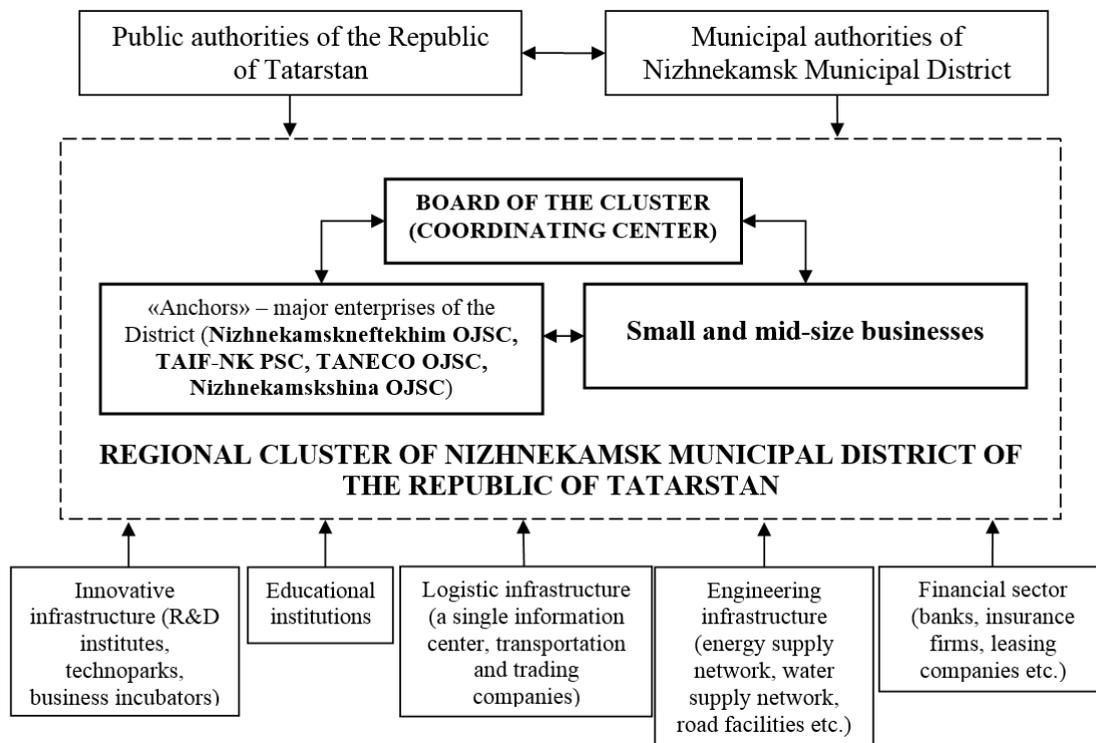

Figure 2. Potential structure of the regional cluster of Nizhnekamsk Municipal District of the Republic of Tatarstan

Having the developed methodological approach at hand, we also forecasted a level of the synergetic effect of formation of the cluster represented by Nizhnekamsk Municipal District of the Republic of Tatarstan. The

predicted synergetic effect amounted to RUB 302,243,817,000.00, which value can be attained by Nizhnekamskneftekhim OJSC, TAIF-NK PSC, TANECO OJSC, and Nizhnekamskshina OJSC by way of formation

of a petrochemical cluster in a mid-term outlook, i.e. during 4 – 5 years of operation of the integrated formation. The indicated amount of monetary funds will be reflected in an increased net profit, revenues and cost of equity of the investigated enterprises. It is worth noting that the synergetic effect will result in a higher taxable income of these enterprises, which, in its turn, would lead to higher tax liabilities to the regional budget of the Republic of Tatarstan. As may be supposed, an aggregate income tax for the investigated enterprises over 4 (four) years of operation within the cluster will rise by RUB 3,814,882,380.00.

Apart from the demonstrated synergetic effect, the clusterization process will produce a number of other positive effects whilst opening new opportunities for realization of certain growth areas for the investigated enterprises as well as the regional economy. Let us review the above mentioned phenomena in terms of their influence on development of the potential cluster of Nizhnekamsk Municipal District of the Republic of Tatarstan.

Formation of the regional cluster will bring about a number of positive economic effects, such as the effects of scale, coverage and experience which mean reduction of product prime cost, more efficient use of human resources, use of aggregate production factors. These effects can lead to a sizable increase in the business operations profitability of the money-losing enterprise Nizhnekamskshina as well as other members of the cluster.

Within the framework of the investigated integrated structure a single marketing and sales policy is formed, which could help improve the market standing of the involved enterprises using a number of methods including implementation of an up-to-date logistic system, enhancement of attractiveness of trademarks by means of advertising and application of innovative solutions, and creation of a single brand line.

It is worth noting that cluster-based inter-firm co-operation mainly calls for horizontal type of organization scheme. Such an approach allows for flexible specialization, facilitates contracting activities, and contributes to faster expansion of innovations. This structure will help forward the growth within the territory of Nizhnekamsk Municipal District around the forming cluster of small businesses, which undoubtedly will contribute to higher tax liabilities to the budget, incorporation of a number of socially significant small businesses along with creation of new job places.

At the same time, one of the priority areas of activity of clusters is innovations. When it comes to this business area, it is advisable that an industrial technopark should be created on the basis of the cluster formed by the investigated enterprises. An effectively running technopark may become a critical element in the innovative infrastructure of the regional cluster, and as a result it will represent a driving force for innovative growth of Nizhnekamsk Municipal District of the Republic of Tatarstan.

In co-operation with the municipal authorities and local educational institutions, based on the experience gained by the leading foreign clusters, a regional cluster could develop, offer and provide financing of the target program intended for manpower training for the involved enterprises. Implementation of such a program will bring about formation of a system of guaranteed employment of young specialists and acquisition by them of additional applied knowledge and practical skills as well as lead to enhancement of quality of training and development of educational institutions. This line of activities, in its turn, will contribute to upgrading the education in Nizhnekamsk Municipal District of the Republic of Tatarstan, which fact suggests significance of the proposed project.

5. Conclusion

The conducted comprehensive study demonstrated that the proposed project of formation and development of the regional cluster represented by Nizhnekamsk Municipal District of the Republic of Tatarstan is an economically validated concept representing an effective strategic route forward for social and economic growth of the territory. This proves that in the current economic environment the clusterization approach is a promising area for improvement of operational and financial performance and upgrading of production engineering at domestic enterprises as well as the driving force for enhancement of competitive strength of the entities making part of the Russian Federation. Furthermore, the clusterization approach may become a driving force for economic growth of the country as a whole.

References

[1] *Boosting Innovation: The Cluster Approach*, OECD Proceedings. OECD Publishing. Paris, 2012.

[2] Dyrdonova, A.N., "Clustering petrochemical industry of the Republic of Tatarstan", *Bulletin of the Kazan Technological University*, 16 (12). 221-224. 2013.

[3] Dyrdonova, A.N., "Formation and development of elements of innovation infrastructure in the region", *Management of economic systems: electronic scientific journal*, 12 (60). 2014. [Online].

[4] Dyrdonova, A.N., "Methodical bases of potential clustering of regional economic systems", *Business. Education. Law. Bulletin of the Volgograd Business Institute.* 1 (26). 252-262. 2014.

[5] Isbasoiu, G.M., *Industrial Clusters and Regional Development. The Case of Timisoara and Montebelluna. MPRA Paper* No. 5037. 2012. [Online].

[6] Ketels, C., *Cluster Initiatives in Developing and Transition Economies.* Center for Strategy and Competitiveness. Stockholm, 2012.

[7] OECD *Reviews of Regional Innovation: Competitive Regional Clusters: National Policy Approaches*. OECD Publishing, Paris, 2013.

[8] Porter, M.E., *The Competitive Advantage of Nations.* New York: Free Press, 2010.