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Assessment of the Potential of Clusterization of Fuel and Energy Complex of the Sakha Republic (Yakutia)

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Abstract

Background/Objectives: The article deals with the issues of clusterization of the region's economy. The objective of research is to assess the potential of clusterization of basic region's economic sectors. **Methods/Statistical Analysis:** On the ground of study of methodical basis of clusterization the authors suggest a complex methodical approach to the establishment of regional industrial cluster. It consists of 3 stages and defines a system of internal coefficients and key figure blocks, characterising potential of clusterization of the region's economy. Author's approach also suggests criteria of assessment of clusterization of basic region's economic sectors (low, middle and high). **Findings:** According to suggested methodical approach the authors analysed and assessed social and economic figures of subjects of the Far Eastern Federal District. This revealed that in the Sakha Republic (Yakutia) the "extraction of commercial minerals" and "production and distribution of electricity, gas and water" are main types of economic activity, which can serve as basis for establishment of regional industrial and intraregional clusters. For practical approval of potential of clusterization the authors have considered fuel and energy complex of the Sakha Republic (Yakutia) (FEC SR (Ya)). **Applications/Improvements:** The results of calculations show high level of potential of clusterization. The authors also suggest a structural pattern (a model) of fuel and energy cluster of SR (Ya).

Keywords: Assessment Method, Fuel and Energy Cluster, Index System, Methodical Approach, Potential of Clusterization, Types of Economic Activity

1. Introduction

Under modern conditions of unstable global and local economy, the issue of improvement of competitiveness becomes very important. Currently in foreign and Russian practice this cluster approach of organisation of manufacture is considered as one of the most efficient instruments to improve competitiveness of economy[1-3]. In this regard the study of questions of clusterization in broad terms and problems of finding and assessment of potential clusters in subjects of the Russian Federation in particular is a crucial task not only for national but also for regional economy. We think that in this contest in order to solve the issues of region economy clusterization it is of foremost importance to assess the potential of clusterization of the region's economic sectors.

With that in view the authors have solved following tasks:

- studied methodical basis for assessment of potential of region's economy clusterization;
- suggested complex methodical approach to development of regional industrial clusters;
- based on analysis and assessment of statistic data on economic development of the region, the authors have chosen the type of economic activity (basic economic sector) for clusterization;
- - made calculations and assessment of potential of clusterization and basic region's economic

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sectors through the example of FEC SR (Ya).

According to the results of study the authors suggested a structural pattern (a model) fuel and energy cluster of SR (Ya).

2. Materials and Methods

Problems of clusterization, methodological and methodical approaches to different its aspects are studied in works of many foreign scientists[4-16] as well as Russian[17-24].

Analysis of foreign practice of cluster finding is presented in works of Russian scientists[21,22,24]. According to them the most well-known methodological approaches are the methods of M. Porter of the European Cluster Observatory. Major methodical approaches can be divided into qualitative and quantitative methods of identification and assessment of clusters or their combinations in different variants. Quantitative assessment is mostly made with the help of methods of location quotient, specialisation, population-based industry location quotient, method of 'input-output' tables and other calculations based on different figures of social and economic development of economy. Qualitative assessment is performed through different methods of expert evaluation, 'swot-analysis' method etc. Nevertheless at present there is no single methodical approach to identification and assessment of clusters[20].

After study and analysis of theoretical and practical basis of clusterization of economic sectors, the authors suggest a complex 3-stage approach to assessment of formation of regional industry clusters (Table 1)[20].

Within the second stage for the assessment of potential of clusterization the authors suggest using the method of estimation of aggregated integral index of the potential of region's economic sectors clusterization (I_{pot}), which is adapted on the basis of the method of integral estimation of region's innovation potential[19]. According to the authors, the clusterization potential, as well as innovation potential, in its turn consists of academic, productive and infrastructural components[20]. In this regard a correct choice of inner indicators (quotients) is very important for the most exact representation, i.e. the choice of basic index system for qualitative assessment of potential of clusterization of region's economy.

Gross resulting value of an aggregated index of potential of clusterization and basic region's economic sectors (I_{pot}) can be calculated by following formula:

Table 1. Stages of methodical approach to clusterization of basic economic sectors of the region

Stages	Description of stages
I. Estimation of level of social and economic development of the region	Analysis of trends of region development on the basis of figures of social and economic development. Recognition of basic industrial sectors (groups of sectors) according to the types of economic activity based on quantitative assessment of potential of clusterization (location quotient and population-based industry location quotient). Decision according to the results of estimation of viability or non-viability of development of basic sector based on formation of a cluster.
II. Assessment of potential of clusterization and formation of a cluster (cluster initiative).	Finding of basic enterprises and key partners (participants) of a cluster. Recognition of factors and figures characterising basic components of a cluster. Assessment of a cluster potential (academic, productive, infrastructural and organisational potentials). Development of a program project for establishment and development of a cluster (cluster initiative).
III. Realisation of a program for establishment and development of a cluster.	Realisation of program measures for establishment of a cluster. Creation of cluster management body. Monitoring of efficiency of cluster activity.

$$I_{pot} = \sqrt{\sum_{i=1}^{m} (I_i)^2} \quad (1)$$

where: I_i – indexes of corresponding blocks (potentials) ($0 \le I_{pot} \le 1$);

m – quantity of groups of indexes.

I_i is calculated as an arithmetical mean of internal controlled parameters:

$$I_i = \sum_{i=1}^{m} K_{ij} / n \quad (2)$$

where: K_{ij} – internal controlled parameter, i – number of the group of indexes,

n – quantity of an inner parameter of i-group.

All the internal calculated indexes K_{ij} are normalized (reduced to a relative number) by a maximum value in the group of indexes by the following formula:

$$K_{ij} = \frac{x_{ij}}{x_{ij}^{max}} \quad (3)$$

where: x_{ij} – values of internal parameters (quotients), i – number of a constituent, j – number of an internal parameter in group i;

Thus, each index I_i consists of several quotients within the interval of $0 \leq I_i \leq 1$.

The authors suggest following criteria of assessment of the potential of clusterization of basic economic sectors:

- low level, if $0 \leq I_{pot} \leq 0,5$;
- middle level, if $0,5 \leq I_{pot} \leq 0,75$;
- high level, if $0,75 \leq I_{pot} \leq 1,0$;

In this article the authors made calculations using statistical data provided in the statistics digest of the Russian Federal State Statistics Service in SR (Ya) and annual abstracts "The Regions of Russia. Socio-economic Indicators", as well as actual technical and economic data of manufactures included into the structure of a cluster.

We think that the suggested method shall allow the most objective assessment of a potential of clusterization of basic region's economic sectors in the large and by each constituent separately.

3. Results and Discussion

According to the first stage of suggested methodical approach the authors have analysed social and economic parameters of the subjects of the Far Eastern Federal District (FEFD) in 2011-2013. Table 2 shows the places of the Sakha Republic (Yakutia) among other regions of Russia by its basic social and economic parameters.

Analysis of the table reveals that the Sakha Republic (Yakutia) is in top-10 subjects of the Russian Federation (RF) by following statistical indicators places through years (Table 3):

- "gross regional product per capita" (5,5,7);

Table 2. Places of the Sakha Republic (Yakutia) among other regions of Russia by its basic social and economic parameters in 2011-2013

No	Parameters	Places			Increase (+), decrease (-), no change (=)
		2011	2012	2013	
1.	Occupational level	50	38	34	+
2.	Average monthly money income per capita	11	12	11	-+
3.	Number of higher professional education students of per 10,000 of persons	29	33	30	+-
4.	Gross regional product per capita	5	5	7	+-
5.	Basic assets in the economy (total reported value) at the year-end	34	30	29	+
6.	Volume of shipped own-produced goods, complete works and services using own resources in following types of economic activity:				
	- extraction of commercial minerals;	8	8	8	=
	- manufacturing activity;	66	68	70	-
	- production and distribution of electricity, gas and water.	30	30	30	=
7.	Tax revenues, imposts and other mandatory payments to the budget system of Russia per capita	10	18	20	-
8.	Fixed investments per capita	9	8	7	+

- "volume of shipped own-produced goods, complete works and services using own resources in "extraction of commercial minerals" (8,8,8);

- "fixed investments per capita" (9,8,7).

Positive changes are observed by following indicators: "basic assets in the economy" from the 34th place in 2011 to the 29th place in 2013; "occupational level" from the 50th place to the 34th place. Negative changes: "tax revenues, imposts and other mandatory payments to the budget system of Russia per capita" from the 10th place to the 20th place; "manufacturing activity" from the 66th place to the 70th place; "fixed investments per capita" from the 9th place to the 7th place. However, basic indicators of social and economic development of the Republic are considered higher than average.

Further we shall consider the dynamics of volume of shipped own-produced goods, complete works and services using own resources by different types of economic activity in the Sakha Republic (Yakutia) in 2010, 2012 and 2013 (Figure 1).

The dynamic shows that the "extraction of commercial minerals" is the leading type of economic activity in the Sakha Republic (Yakutia), as there is a positive increasing dynamics (increase of indicators in 1.58 times in 2013 in comparison to 2010). If we compare an indicator of "extraction of commercial minerals" with other indicators of economic activity, it is obvious that it is much higher (in 2013 it was in 12.17 higher than an indicator of "manufacturing activity" and 6.75 times higher than "production and distribution of electricity, gas and water").

Table 3. Volume of shipped own-produced goods, work and services rendered using own resources by types of economic activity

(in effective prices; million of RUB)	Extraction of commercial minerals			Manufacturing activity			Production and distribution of electricity, gas and water		
	2010	2012	2013	2010	2012	2013	2010	2012	2013
The Russian Federation	6217952	8950066	9748137	18880737	25110611	27132731	3665280	4160147	4491574
The Far Eastern Federal District	702239	1067496	1098304	309172	396358	424852	198707	227002	244195
The Sakha Republic (Yakutia)	214206	317116	338681	24515	28029	27823	37946	45863	50131
The Kamchatka Region	6326	7779	5694	37350	42342	42785	14948	15517	16094
Primorski Krai	10656	13869	13637	104562	150092	181041	47025	53814	55777
The Khabarovsk Territory	25291	41711	43233	93965	120201	114933	39891	44974	50372
The Amur Region	26599	53473	49747	18568	22025	21952	26935	26915	27547
The Magadan Region	29546	59256	53178	2921	3895	3797	8183	10399	11975
The Sakhalin Region	353836	539776	558867	23694	25521	28020	13965	18533	18429
The Jewish Autonomous Region	286	398	414	2998	3648	3835	2866	3014	3235
The Chukotka Autonomous Region	35494	34116	34853	599	605	666	6950	7971	10635

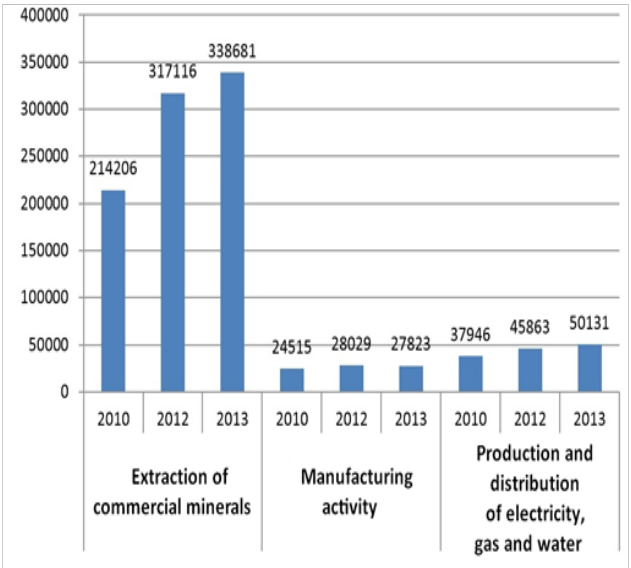

Figure 1. Dynamics of volume of shipped own-produced goods, complete works and services using own resources by different types of economic activity in the SR (YA) in 2010, 2012 and 2013, million RUB.

Source: The Regions of Russia. Socio-Economic Indicators. 2014: P32 Statistics digest. Rosstat. Moscow, 2014. http://www.gks.ru

In order to substantiate a possibility of formation of regional industrial clusters with the help of location quotient and population-based industry location quotient methods, the authors have made a quantitative assessment of potential of clusterization of subjects of the Far Eastern Federal District by types of economic activity in 2013 (Table 4).

Data in the Table 4 show that in the Sakha Republic (Yakutia) judging by the location and population-based industry location quotients the regional industrial clusters can be potentially formed within an extraction industry ("extraction of commercial minerals") and an industry of "production and distribution of electricity, gas and water", as they are the basic elements of fuel and energy complex and mineral resources sector. The leading regions are the Magadan and Sakhalin Regions, as well as the Chukotka Autonomous Region. In the territory of these regions there are active oil-production, gas producing and gold mining enterprises.

Then, according to the methodical approach, suggested by the authors, they have made an assessment of potential of clusterization of region's basic economic sec-

Table 4. Quotients of potential of clusterization of the Far Eastern Federal District by types of economic activity in 2013

Region	Кл - location quotient			Кдп - population-based industry location quotient		
	extraction of commercial minerals	manufacturing activity	production and distribution of electricity, gas and water	extraction of commercial minerals	manufacturing activity	production and distribution of electricity, gas and water
The Russian Federation	1.00	1.00	1.00	1.00	1.00	1.00
The Far Eastern Federal District, including:	2.76	0.38	1.33	2.60	0.36	1.25
The Sakha Republic (Yakutia)	4.26	0.13	1.37	5.23	0.15	1.68
The Kamchatka Region	0.30	0.82	1.87	0.26	0.71	1.61
Primorski Krai	0.17	0.80	1.48	0.10	0.49	0.92
The Khabarovsk Territory	0.68	0.65	1.71	0.48	0.45	1.20
The Amur Region	1.44	0.23	1.73	0.90	0.14	1.09
The Magadan Region	4.70	0.12	2.30	5.21	0.13	2.55
The Sakhalin Region	5.91	0.11	0.42	16.77	0.30	1.20
The Jewish Autonomous Region	0.07	0.22	1.12	0.04	0.12	0.61
The Chukotka Autonomous Region	4.84	0.03	3.21	10.17	0.07	6.74

tors. To try out suggested method, the authors chose the FEC SR (Ya) as one of basic budget revenue generating economy sectors – not for the region only, but also for the whole Russia. At present the oil and gas industry of Russia makes 40% of the federal budget through the taxes and more than 50% of the state's exchange earnest[25].

The republic already has the economic base for formation of regional fuel and energy cluster, consisting of production, service and amenity infrastructures of FEC, as well as strong mineral and raw materials potential ready for development.

Fuel and energy resources of the Sakha Republic (Yakutia) are represented by geological reserves of coal (2.5 tln. tonnes), natural gas (9.4 tln. m^3) and oil (19.7 bln tonnes). In addition, commercial reserves of oil are more than 400 mln. tonnes, of gas – abount 2 tln. m^3. More than 80% of discovered reserves of oil and 65% of gas are concentrated in three fields within Nepa-Botuobiya oil-and-gas bearing area (Verkhnechonsk, Talakan and Chayanda) and Kovykta field in the Angara-Lena oil-and-gas bearing area. Commercial reserves of coal are estimated at 14.5 bln. Tonnes and 9.6 bln. tonnes are included in productive categories (including 7.3 bln. tonnes of high-quality metallurgical coal in the South Yakutia. In the Tokkin coal area a large field was discovered – the Elgin field. Its reserves in the north-west part were studied in details and are estimated at 2.1 bln. tonnes. It is ready for open-pit mining. In the Central Yakutia there are large reserves of steam coal – the Kangalas field – where there are not less than 5.2 bln. tonnes of commercial reserves with a stripping ratio form 1 to 3.5 m^3/tonne[25].

In the arctic zone of the republic, scientists have also found rich reserves of energy resources. In the territory between the Kolyma and Indigirka rivers there is a large Zyryan coal field with standard reserves of metallurgical and baking coal amounting to 23.1 bln. tonnes. In-place reserves of coal on the Begichev islands amount to 1147.6 mln. Tonnes[25]. Commercial reserves of oil are located in the Nordvik and Tyzhno-Tigyansk fields, as well as in the Syndassko territory (the Kozhevnikova Bay), natural gas – in the Alaseja valley between the Kolyma and Indigirka rivers.

In latest years (2010-2013) we observe an increase of extraction of fuel and energy resources in the republic – except for brown coal. Oil extraction increase by more than 2 times and in 2013 amounted to 7551.2 thousand tonnes (Table 5).

Table 5. Extraction of fossil fuels in the Sakha Republic (Yakutia) in 2010-2013

Type of fossil fuel	2010	2011	2012	2013	2013/ 2010, %
Coal, thousand tonnes black brown	11094 10896 198	9834 9628 206	12256 12007 249	11883 11701 182	107 107 92
Oil, thousand tonnes	3425.8	5513.8	6713.4	7551.2	220
Unstable gas condensate, thousand tonnes	91.7	88.9	93.1	94.4	103
Combustion natural associated gas, mln. m^3	1906.7	1886	1994.8	2021.0	106

In order to assess the potential of clusterization, special attention should be given to the analysis of the operating structures of the republic's FEC. The authors have studied operating, infrastructure, academic and other elements of the FEC, the enterprises of which are potential participants of the cluster.

Basic manufacturing companies of FEC in the republic are:

- oil producing companies: OOO TAAS-Yuryakh Neftegazdobycha, ZAO Irelyakhneft and OAO Surgutneftegas. In the latest years these companies expanding their capacity by activation of new oil/gas-condensate fields (e.g. Srednebotuobin, North Talakan, East Alinskoye and other fields) due to the construction of the ESPO pipeline;
- gas producing enterprises: OAO Yakutsk Fuel and Energy Company, OAO ALROSA-Gaz, OAO Sakhatransneftegaz and OOO Lensk-Gaz. Their aggregate capacity is 1.9 bln. m^3 of gas and 89 th. tonnes of gas condensate[25]. Currently the republic actively works on installation of gas service in the rural area.
- coal producing enterprises: OAO KhK Yakutugol, incorporating the Dzhebariki-Khaya colliery, Kangalassky and Zyryansky open pits (providing for central and north regions), and Neryungrinsky open pit (south regions of the

republic and export to the APR countries). Also, following companies work in the territory of the republic: OAO Mechel Mining, OOO UK Kolmar, ZAO KolmarProekt, ZAO Malye Razrezy Neryungri, OOO Erchim Tkhan, OAO Kirovskiy Ugolnyy Razrez, OAO Suntartseolit, OAO Telen.

Major priority of establishment of regional FEC cluster is the implementation of the state program for large scale complex development of energy reserves and subsurface management sector, mainly in order to provide power supplies to the Far Eastern regions and to export it to the countries of Asian-Pacific Region. Currently the energy sector of the Sakha Republic (Yakutia) faces a task to develop several FEC fields in western and southern Yakutia (Talakan and Chayanda oil-and-gas bearing regions; Elgin, Denis and Chulmakan fields of metallurgical and steam coal). Implementation of export projects shall allow establishment of stable basis of increasing revenue into consolidated budget of not only Russian Federation, but also of Far Eastern regions and particularly of the Sakha Republic (Yakutia).

Quite real perspectives of development of FEC in SR (Ya) are set out in state documents, including the "Pattern of Complex Development of Productive Forces, Transport and Energetics in the Sakha Republic (Yakutia) by 2020" and the "Energy Strategy for the Sakha Republic (Yakutia) for the period until 2030" (Table 6).

As it is clear from the prognosis, the volume of coal extraction shall be increased by 2.4 times by 2030. Therefore, volume of export to the countries of APR and to other regions of Russia (including the Far East) shall also be increased. The document also foresees transportation of 3.8 to 10.5 bln. m^3 of natural gas to the countries of APR (China, in particular) via the gas transmittal pipeline[25].

A railway on the left bank of the Lena River in the Nizhny Bestyakh settlement is a very important positive factor. Currently a question on the agenda is continuation of construction of the railway via a bridge to the other bank, where the Kangalas coal field is located. This would be an efficient solution of return load of the railway to make its use more rational.

Thus, further realisation of strategic direction for more extensive development of unique fuel and energy resources of the region condition the formation of a regional FEC cluster with intra-regional and export focus.

Using abovementioned method, we have calculated internal indexes (indicators, characterising the potential of a fuel and energy cluster, as well as aggregated integral index) – the basic assessment parameters of clusterization potential. Calculations are made on the basis of statistical data from the "Concept of Development of Coal Mining Industry in the Sakha Republic (Yakutia) by 2030".

As it was already mentioned, a choice of internal indicators characterising the cluster's potential is very important. We have chosen following internal indicators (quotients), characterising academic, productive and infrastructural potentials, the content of which authors consider sufficient for representation of potential of FEC SR (Ya) (Table 7).

According to the suggested method on the basis of chosen system of internal indicators (quotients) we have calculated three basic components of clusterization potential: academic - I_1; productive - I_2 and infrastruc-

Table 6. Prognosis of growth rates for extraction of fuel and energy resources in the Sakha Republic (Yakutia) by 2030

	Sectors	Units	2015	2020	2025	2030
1.	Coal,	mln. tonnes	17.0	30.6	33.6	40.5
	including: - metallurgical;		13.6	22.7	20.7	23.2
	- steam		3.4	7.9	12.7	17.3
	Coal supply	mln. tonnes				
	including: - to the regions of Russia;		4.1	4.8	4.8	5.3
	- export		8.2	14.5	12.9	16.5
2.	Oil and gas condensate,	mln. tonnes	8.2	11.3	11.5	11.7
	including export		7.952	9.987	10.212	10.42
3.	Natural gas,	mln m3	2637.0	6893.0	10460	17078
	including export		-	3867.0	7148.0	10481.0

Table 7. System of indicators of (quotients) of potential of FEC SR (YA) clusterization

x_{ij}	Indicators	2010	2011	2012	2013
Academic potential - I_1					
x_{11}	Share of internal expenses for R&D in GRP of SR (YA)	0.430	0.410	0.400	0.410
x_{12}	Share of expenses for technological innovations in the sector "extraction industry" in cost overall in SR (YA)	0.338	0.031	0.627	0.638
x_{13}	Share of graduated skilled labourers in the special field "well-drilling, gas and oil extraction" from basic vocational schools in the total of graduates in the field of "extraction industry"	0.316	0.280	0.592	0.117
x_{14}	Share of graduates in the special field "geology, mineral exploration and mining" from secondary vocational schools in the total number of graduates	0.013	0.017	0.009	0.011
x_{15}	Share of graduates in the special field "geology, mineral exploration and mining" from higher vocational schools in the total number of graduates	0.037	0.032	0.030	0.027
x_{16}	Share of North-Eastern Federal University graduates employed at enterprises of fuel and energy sector in the total number of graduates employed at production enterprises	0.073	0.079	0.084	0.079
Productive potential - I_2					
x_{21}	Share of employees of FEC companies in the total of employees of extraction industry in SR (Ya)	0.360	0.319	0.347	0.261
x_{22}	Share of operating FEC enterprises in the total of extraction industry enterprises in SR (Ya)	0.174	0.187	0.192	0.179
x_{23}	Share of volume of shipped own-produced goods, complete works and services using own resources of FEC enterprises in the total of volume of extraction industry enterprises in SR (Ya)	0.395	0.408	0.403	0.405
x_{24}	Share of export of coal resources in the total of export of mineral commodities in SR (Ya)	0.147	0.205	0.164	0.155
x_{25}	Ratio of wear of fixed assets of FEC to the total of wear of fixed assets of extraction industry enterprises in SR (Ya)	0.856	0.941	1.068	1.042
x_{26}	Share of FEC enterprises in the total amount of profit of extraction industry enterprises in SR (Ya)	0.361	0.228	0.104	0.155
Infrastructural potential - I_3					
x_{31}	Ratio of average monthly salary of employees of FEC enterprises to average monthly salary in extraction industry of SR (Ya)	1.048	0.934	0.905	0.871
x_{32}	Ratio of indicator of housing per capita in municipal areas by FEC enterprises to average indicator of housing per capita in SR (Ya)	1.095	1.108	1.114	1.130

x_{33}	Ratio of indicator of extraction of FEC commercial minerals per capita to average indicator of extraction of commercial minerals per capita in SR (Ya)	0.395	0.408	0.403	0.405
x_{34}	Share of tax revenues in the budget from FEC enterprises in the total of revenues extraction industry enterprises of SR (Ya)	0.486	0.368	0.205	0.340

Table 8. Normalized quotients (K_{ij}) of potential of FEC SR (YA) clusterization in 2010-2013

K_{ij}	2010	2011	2012	2013
Academic potential - I_1				
K_{11}	1,00	1.00	0.64	0.64
K_{12}	0.79	0.08	1.00	1.00
K_{13}	0.73	0.68	0.94	0.18
K_{14}	0.03	0.04	0.01	0.02
K_{15}	0.09	0.08	0.05	0.04
K_{16}	0.17	0.19	0.13	0.12
Productive potential - I_2				
K_{21}	0.42	0.34	0.32	0.25
K_{22}	0.20	0.20	0.18	0.17
K_{23}	0.46	0.43	0.38	0.39
K_{24}	0.17	0.22	0.15	0.15
K_{25}	1.00	1.00	1.00	1.00
K_{26}	0.42	0.24	0.10	0.15
Infrastructural potential - I_3				
K_{31}	0.96	0.84	0.81	0.77
K_{32}	1.00	1.00	1.00	1.00
K_{33}	0.36	0.37	0.36	0.36
K_{34}	0.44	0.33	0.18	0,30

Source: Composed by the authors on the basis of calculations.

tural - I_3, as well as integral value of an aggregated index of FEC SR (Ya) – I_{pot}.

Table 8 represents normalized quotients of potential of FEC SR (Ya) clusterization in 2010-2013.

Result of calculation of aggregated integral index of FEC SR (Ya) clusterization potential according to the abovementioned criteria of assessment of potential of clusterization of basic economic sectors. Results demonstrate high level of potential ($I_{pot} \subset [0,78;0,95]$) (Figure 2).

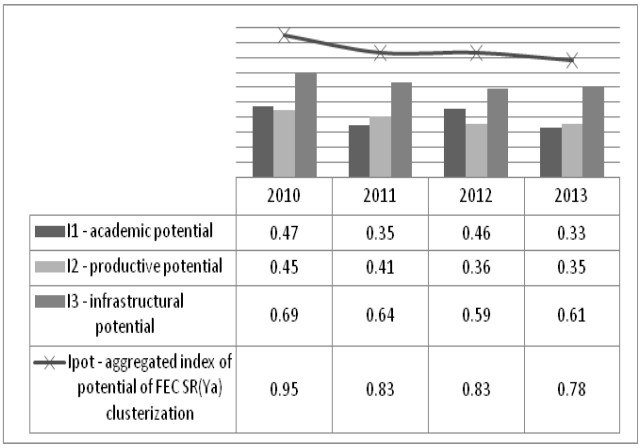

Figure 2. Dynamics of change of aggregate integral index of of FEC SR (YA) clusterization potential (I_{pot}) and its components (I_i) in 2010-2013.

In general the diagram demonstrates decreasing dynamics of indicators, which can be explained by crisis of the country's economy: raising of tariff rates for energy products, decline of RUB rate to UDS and EUR, inflation etc. However, despite all these negative factors, the prognosis is quite favourable as the volume of fuel and energy resources extraction is increasing. Another positive moment is the highest value of infrastructural potential index (I_3), as the FEC enterprises are located in areas with rather developed transport, energy and social infrastructure (in South and West Yakutia).

Based on performed analysis of potential participants of a cluster, region's special features, condition and perspectives of development of FEC SR (Ya), the authors designed a structural pattern of regional fuel and energy cluster (Figure 3):

1. *Productive potential* (production core of the cluster) – main production enterprises of FEC SR (Ya), which operate directly in the field of fossil fuels extraction;

2. *Infrastructural potential* – participant of cluster (companies and organisations), who produce goods and

provide services, necessary for development of fuel and energy cluster. It in its turn has following components:

- social infrastructure (construction, renovation, insurance and other companies);
- production infrastructure (supply, geological and other companies, providing continuous work of the cluster's core).
- financial and credit infrastructure (financial aspect of the cluster: banks, funds, investment companies, financial and credit organisations);
- transport and logistics infrastructure (inland navigation company, railway company, freight air carrier etc.).

3. *Academic potential* – intellectual core of the cluster. Scientific and educational organisations, providing highly qualified manpower, studying the state and perspectives of FEC development. It includes:

- research organizations (Research Institute of the North-Eastern Federal University, Yakutia Scientific Centre of the Siberian Department of the Russian Academy of Sciences, industry research centres, laboratories etc.);
- schools of higher, secondary and basic vocational education of the republic (M.K. Ammosov North-Eastern Federal University, Neryungri Technical Institute (branch) of NEFU, Mirny Polytechnic Institute (branch) of NEFU, Chukotka branch of NEFU in Anadyr, Aldan secondary technical school, Mirny secondary industrial school, Neryungri Polytechnic college, Professional lyceum No. 7 in Yakutsk etc.).

4. *Organisational potential* (legislative and executive bodies of power, political organisations) – a component of the cluster, responsible for realisation of policy of FEC development and government support. Following ministries and bodies can be part of a cluster: Ministry of Industry, Treasury, Ministry of Economy, Ministry of Education, State committee of SR (Ya) on Geology and Subsurface Management, State Assembly (Il Tumen) of SR (Ya) and others.

Normative-technical basis for realisation of programs of local authorities for FEC development are the following state programs: the Pattern of Complex Development of Productive Forces, Transport and Energetics in the Sakha Republic (Yakutia) by 2010, the State program

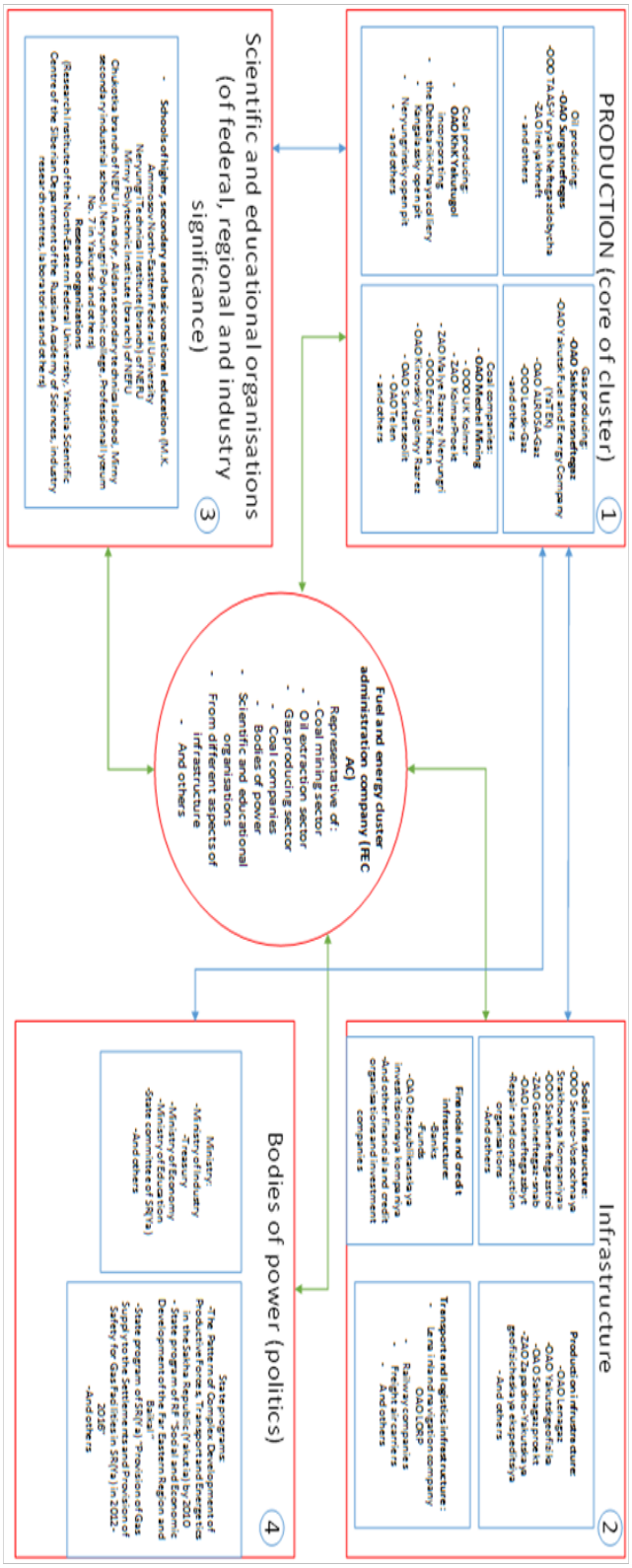

Figure 3. Structural pattern of fuel and energy cluster of the Sakha Republic (Yakutia).

of RF "Social and Economic Development of the Far Eastern Region and Baikal", the State program of SR (Ya) "Provision of Gas Supply to the Settlements and Provision of Safety for Gas Facilities in SR (Ya) in 2012-2016" and others.

Coordination of cluster activity can be exercised by a voluntary association (a union), created by participants of a cluster in a form of association, non-profit partnership, holding company etc. Also, the initiator of establishment of such body can be local authority represented by the centre of cluster development.

We think that an administration company of FEC cluster should include representatives of all the cluster participants: coal mining, oil extraction, gas producing sectors, coal companies, bodies of power, scientific and educational organisations, from infrastructure companies and other participants of cluster interested in its development.

4. Conclusions

Based on the analysis of social and economic development of the region and quantitative assessment of the potential of clusterization (location quotient and population-based industry location quotient), the authors have identified basic sectors of economy and proved viability of establishment of regional industry cluster. Following types of economic activity have potential for establishment of regional and interregional clusters: "extraction of commercial minerals" (mineral industry) and sectors of "production and distribution of electricity, gas and water" as basic components of fuel/energy and mineral resources sectors.

The authors have identified factors and indicators characterising basic elements of fuel and energy cluster, made an estimation of potential of FEC SR (Ya) clusterization. Based on indexes of scientific and educational, productive and infrastructural potentials, the authors have calculated an aggregated index of potential of clusterization of FEC SR (Ya), which revealed high level of potential according to the criteria suggested herein.

The authors also suggest a structural pattern of fuel and energy cluster of SR (Ya) with all the components of cluster, showing existence of factors contributing to efficient work of newly created regional industrial cluster.

Thus, we think, a methodical approach of assessment of clusterization potential, suggested in this article, gives a possibility to objectively assess potential of clusterization of basic region's economic sectors. Subsequently it shall appoint the structure, form of organisation, the territory of cluster of a group of clusters of regional, interregional or international significance.

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