

# Role of territorial remoteness, economic and social factors in development of Siberian and northern regions of Russia

**A V Myadzelets**

Sochava Institute of Geography, Siberian Branch of the Russian Academy of Sciences, Irkutsk, Russia

E-mail: [anastasia@irigs.irk.ru](mailto:anastasia@irigs.irk.ru)

**Abstract.** The issue of territorial peripherality of particular regions is considered for the case of Siberian and the northern part of Russia. The peripherality is one of the basic spatio-temporal factors that negatively impacts on economic development, its innovativeness, territorial organization and, through it, on a socio-demographic situation of remote areas. This factor intensifies regional disparity which closely connected with some other geographical factors and may essentially reduce the investment efficiency in the state economy. The impact of the factor is assessed through modeling of connection of different socio-economic and demographic parameters. For the model calculation an indication function is applied. The function connects a generalized integral evaluation parameter of study object state (regional territory) with its individual integral parameters of state (socio-economic characteristics) through coefficients calculated by regression methods. Regional distances and transport accessibility, population life quality index and investment efficiency are chosen as generalized integral evaluation parameters. They reflect complex spatial, economic and social peripheral properties of the investigated area. For the analysis the geoinformation database for every region is created with necessary content of socio-economic statistic information for the period 2000-2015. Results of the research are mapped using GIS-methods. The calculation shows that in spite of the evident peripherality because of the geographical location and low level of transport-logistic infrastructure development there is an opportunity to reduce the factor effect for the regions. It might be reached by increasing of investment efficiency and improvement of population well-being and the life quality.

## 1. Introduction

Active modernization of certain sectors of the economy and lagging of remote territories in the economic development are important contemporary processes in the national economic system of Russia. They cause both rapid unexpected and often opposite natural and socio-economic changes. Such transformations of geographical space, deterioration or improvement of development conditions of regional socio-economic system are considered in the context of territorial remoteness from the center and territorial organization which are real phenomena forming under the influence of various socio-economic factors.

The issue of territorial organization, territorial remoteness and their correlation with social and economic situation is considered for the case of Siberian and northern regions of Russia. The study territory is distant from the central part of the country and differed by difficult geographical conditions. It is reflected on their development and organization of economics, establishment of



regional relations and general social attractiveness. Geopolitical situation of last years raises the interest to research and adaptation those areas. Regional geographical environment and socio-economic situation are considered depending on distance between central and remote areas, and interaction between integral characteristics of regional life quality conditions and economic efficiency. Qualitative analysis of spatial differences of regional socio-economic peculiarities and development conditions is fulfilled using mathematic, regression and geoinformation modeling methods. The analyzed period is fifteen years from 2000 to 2015. Used data are published in the official national statistic reports "Regions of Russia".

## 2. Theory and methods

The territorial organization as a geographical process and phenomenon has been studied for a long time [1, 2, 3, 4]. It exists in space and time, connects various factors of the surrounding natural and socio-economic environment and is formed in a natural historical manner [5]. It includes natural, economic and social components, united in interacting territorial geographical systems of different hierarchical level from local to global. The connectivity is manifested as the existence of certain territorial proportions of the production forces, the correlation of production specializations, the interrelationship between the productive and non-productive spheres of the economy and society, taking into account all the prerequisites and limitations of the territorial development [4, 5, 6, 7]. From the other hand, the territorial organization is disclosed through a system of geographical characteristics, information about which is presented as statistical data. They fully and accurately describe the nature, economy and population of the territory through some evaluation function of the combined effect of all factors [8, 9].

The peripherality, or territorial remoteness, is one of the basic spatial-temporal factors that negatively impacts on economic development, its innovativeness, territorial organization and on a socio-demographic situation of remote areas [10, 11]. This factor intensifies regional disparity which closely connected with some other geographical factors and may essentially reduce the investment efficiency in the state economy and level of population life quality.

Some indices are chosen for evaluation and studying the role of territorial remoteness and social and economic factors on regional development. It is spatial peripherality, an integral index of population life quality, and investment efficiency. Spatial peripherality, investment efficiency are indicators of economic development; the integral index of the life quality reflects social well-being and attractiveness of a region. The factors are analyzed through study of complex associations of various socio-economic statistical characteristics. Then comparative assessment is given for every investigated region. These associations are described by both qualitative and quantitative methods such as mathematical modeling and comparative score assessment.

The associations between the socio-economic factors are defined by the mathematical model of an analytic indication function  $U=U(x)$ ,  $x=(x_1, x_2, \dots, x_i, \dots, x_n)$ . The function is reduced to the form  $U(x)=a_1x_1+a_2x_2+\dots+a_ix_i+\dots+a_nx_n+W(a)$  (1) by some mathematical transformations [12], where  $W(a)$  is a transformation function of a number of variables coefficients  $a=(a_1, a_2, \dots, a_i, \dots, a_n)$ . Indicators  $x=(x_i)$  are socio-economic factors of territorial development,  $U(x)$  is an integral index which reveals the state of a geographical system, for example regional social or economic situation. The model coefficients  $a=(a_i)$  characterize association between the factors  $x=(x_i)$  and the integral index  $U(x)$ . Also they show intensity of factor influence on the integral index. The model coefficients are certain properties of local socio-economic conditions [13]. The model structure and coefficients are changed "from region to region" and depend on the geographical situation of the concrete territory. Moreover, using of the indication function model allows to calculate and explain different regional variations of factor association regularities and give some prognosis of economic situation changes.

Three components of model evaluation are chosen for the analysis.

1. Studying the influence of spatial peripherality on the territorial organization is considered through the transport accessibility of regions relative to the central part of Russia. The accessibility index is calculated as the sum of the normalized parameters, such as the distance from Moscow to the

regional centers of the investigated territory, the density of the network of roads and railways, the number of direct flights per day.

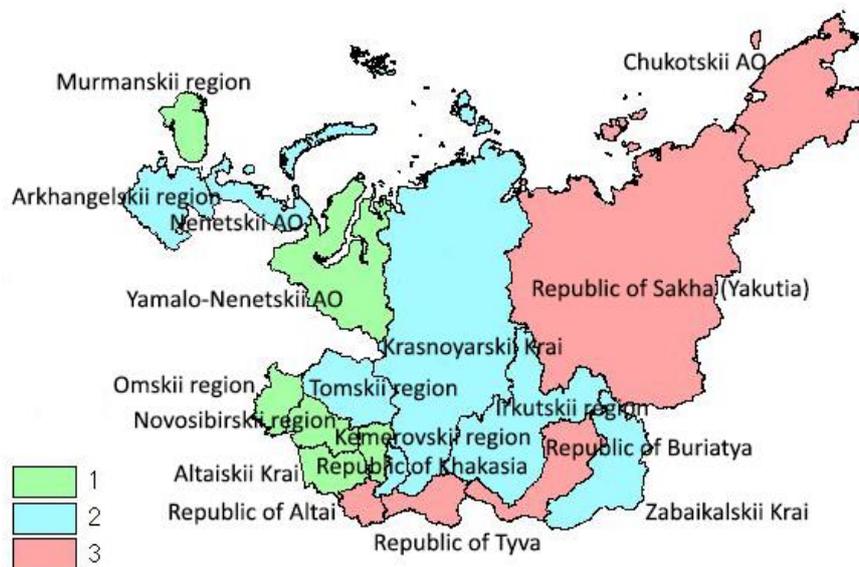
2. The integral index of the life quality is analyzed on the basis of a combination of factors of social and economic well-being that comprehensively characterizes the socio-economic and medico-demographic situation in the regions [12, 14]. Four statistic parameters are chosen for assessing the index. It is the average life expectancy of population, the natural increase of population, the total population income, and the crime level. The integral index of life quality is estimated on the basis of the calculated coefficients of the indication model (1). These coefficients reflect the basic connection between socio-economic well-being factors and the integral indicator and reveal their impact on the population life quality of the region.

3. Investment efficiency is estimated based on associations between investment growth or declining and industry and agricultural production in the regions [13]. This connection reflects peculiarities of economic growth or fall in the economy.

All statistic information and calculated parameters are collected as a socio-economic geoinformation database according regional administration division of Russia. Analysis of statistical data is performed using GIS tools or other statistic programs for correlation analysis. The calculated coefficients and estimated parameters are entered into the database structure and then presented in cartographic form.

### 3. Results and discussion

When studying the influence of spatial factors on the periphery, it was assumed that the entire territory of Siberia and the north is peripheral relative to the central part of Russia. According to the analysis three type of peripheraluty are distinguished. It is the nearest, middle and distant spatial periphery (figure 1).

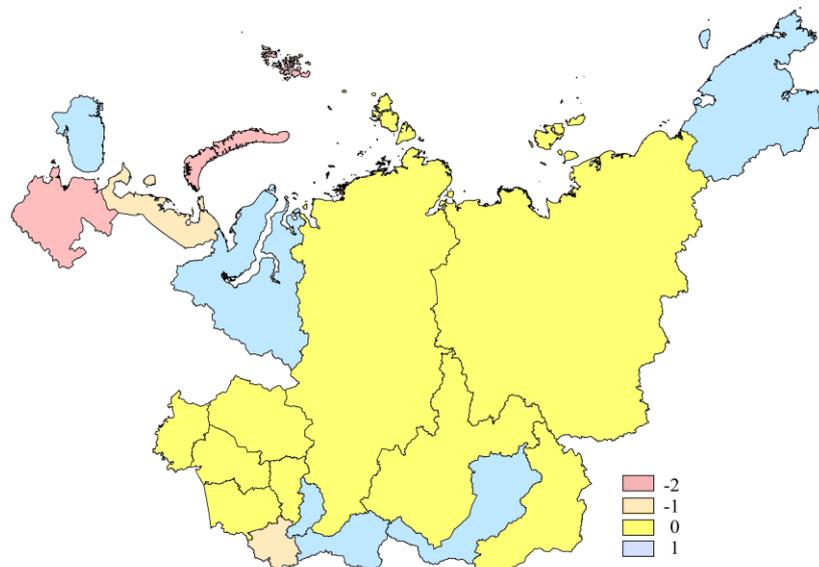


**Figure 1.** Spatial peripherality (remoteness): 1 - nearest; 2 - medium; 3 - distant.

The regions of the nearest periphery include the Novosibirskii, Kemerovskii, Omskii, Murmanskii regions, Altaiskii Krai, and Yamalo-Nenetskii Autonomous Okrug (AO). These regions are closest to the central part of Russia. They have good air communication with the capital and are characterized by medium or high density of railroad and paved road net. Arkhangelskii, Irkutskii, and Tomskii region,

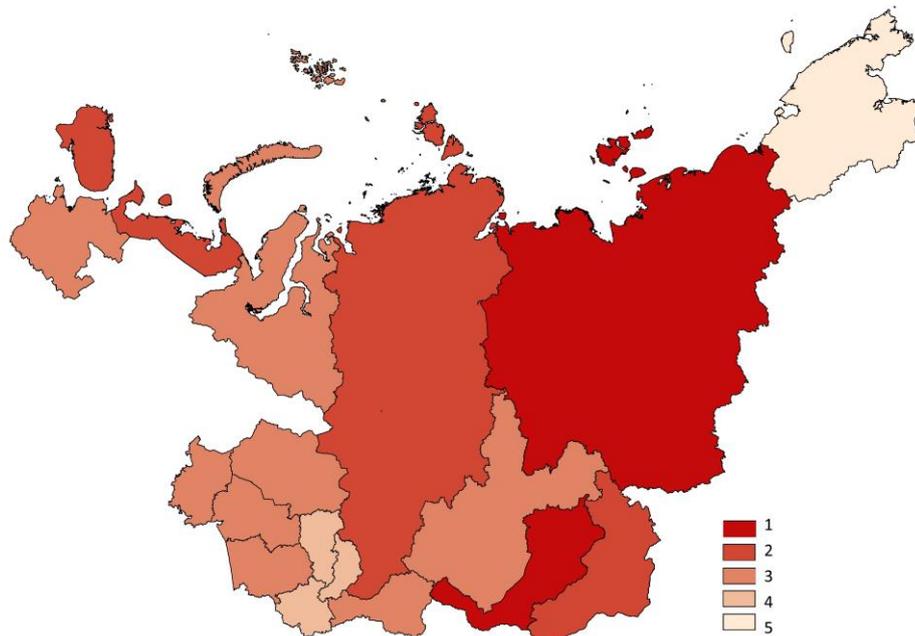
Krasnoyarskii and Zabaikalskii Krai, Republic of Khakasia, and Nenetskii AO are referred to the medium spatial periphery. Republic of Sakha (Yakutia), Tyva, Altai, Buryatia, and Chukotskii AO belong to the distant periphery. These regions are far from the center. They have a rare air connection with Moscow, and there is practically no developed railway network.

Estimation of the integral index of the population life quality is made on the basis of the calculated coefficients of the indication model (1) for each region. Then all regions are ranged according the meaning of the coefficients, with range taking into account changes of the life quality conditions during the fifteen period of time from 2000 to 2015. The regions are divided into four groups (figure 2). The first two groups include regions with deterioration of the life quality index that intensifies their peripherality conditions. These are Arkhangelskii region, Republic of Altai, and Nenetskii AO. Regions without obvious changes of the life quality index over the studied period of time belongs to the third medium category. It includes the Krasnoyarskii, Altaiskii, and Zabaikalskii Krai, Republic of Sakha (Yakutia), Novosibirskii, Tomskii, Irkutskii, Omskii, and Kemerovskii regions. Unexpected results are revealed for the fourth group of regions where two of three factors of social and economic well-being have positively changed and affected the quality of life condition. These are Murmanskii region, Republic of Buryat, Khakasia, and Tyva, Ymalo-Nenetskii and Chukotskii AO. Usually they have outsider position in the national socio-economic rating. It is supposed that improvement of the quality of life in these regions is connected with traditional high level of birth rate, but it is weakened by the influence of the spatial remoteness factor.



**Figure 2.** Integral index of the life quality conditions (see region titles at the figure 1): -2 - very low; -1 - low; 0 - medium; 1 - high.

Analysis and diagnosis of economic conditions is given as an example of investment activity in the regions. Results are based on the modeling the indication function (1) and calculating its coefficients. The lowest investment efficiency (group 4 and 5) is defined for the Kemerovskii Region, Republic of Altai and Khakasia, and Chukotskii AO. The highest level of economic efficiency is determined for group 1 and 2 which include Republic of Buryat and Sakha (Yakutia), Krasnoyarskii and Zabaikalskii Krai, Murmanskii Region, and Nenetskii AO (figure 3). The remaining Irkutskii, Tomskii, Novosibirskii, and Omskii regions, Altaiskii Krai, Republic of Tyva, and Yamalo-Nenetskii AO have an average value of the investment efficiency. Their regional conditions also favorably affect the local economic situation and reduce influence of the factor of territorial remoteness.



**Figure 3.** Regional economic efficiency (see region titles at the figure 1): 1 - very high; 2 - high; 3 - medium; 4 - low; 5 - very low.

Thus, despite the pronounced peripheral factor due to the geographical location of the Siberian and northern regions of Russia and the low level of transport and logistics infrastructure, it is possible to reduce the influence of this factor on territorial development. It can be achieved by increasing the effectiveness of investment and improving the conditions of population quality of life, in particular increasing incomes, stimulating measures to increase birth rate, reducing crime level. At the same time, the efficiency of investments is often associated not with proximity to the center, but with the rate of growth of investment and gross industrial and agricultural output.

#### 4. Conclusion

Modern territorial usage planning involves improving old and working out new approaches for increasing of the economic development level and favorable social conditions. Management of the process of forming of the territorial organization of society is one of the innovative methods of organizing space. The features of territorial organization and regional development are analyzed by the use of methods of geoinformation and mathematical modeling on the example of remoteness, the integral index of the population life quality, and the investment efficiency. These indicators have local and temporal specificity, i.e. are varied from region to region within certain period of time and determine the direction of economic development of the territory.

In the result of analysis the joint influence of the geographical and socio-economic conditions on economic situation of Siberian and northern Russian regions is shown. The comparative assessment is given depending on the local socio-economic indices for every investigated area. The results of the research allow to carry out not only the assessment of the current situation, but to propose ways of its developing and improving.

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