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# Russian regions' educational and innovation potential

O.V. Tolstoguzov
*Institute of economy, Karelian research center of RAS*
*IE KarRC RAS*
Petrozavodsk, Russia
olvito@mail.ru

M.A. Pitukhina
*Institute of economy, Karelian research center of RAS*
*IE KarRC RAS*
Petrozavodsk, Russia
maria.pitukhina@gmail.com

L.M. Kulakova
*Institute of economy, Karelian research center of RAS*
*IE KarRC RAS*
Petrozavodsk, Russia
dialogkarelia@gmail.com

***Abstract*—Russian regions' comparative analysis in terms of both their educational and innovative potential was conducted and aimed at Russia's spatial restructuring processes scrutinizing as well as response preparation to new technological challenges. Several conclusions were made dealing with regions' economic, scientific and technological development. Innovation patterns development as well as of educational space based on meso-econometric models is shown. It was concluded that in order to increase intellectual potential concentration and to benefit from knowledge economy, an active state policy is highly necessary aimed at geographical contradictions in educational and innovation activity eliminating as well as innovation process agents' collective models development.**

***Keywords—knowledge economy, region, economic space, educational and innovative potential, innovative activity)***

## I. INTRODUCTION

Nowadays a rapid knowledge economy development is pacing. Economic space has become more permeable in contemporary world, mobility flows have increased, subjects' interdependence has also grown, range of economic activities has expanded guided by the fourth industrial revolution [9] radically changing global labor division. In 2015 number of ICT professionals, software developers and analysts, data bases and networks specialists, technicians in ICT operation, telecommunications and broadcasting was estimated about 1.2 million (about 2% of employees) [10].

The key elements of knowledge economy are dealing with high-tech concentration and human resources skills [18]. Undoubtedly, the progress is being ensured via effective management of knowledge reproduction. Its basic element is linked to qualified human resources training in a system of higher and postgraduate education [18]. Nowadays the intelligence is becoming a brand new driver both for digital society and knowledge economy [11]. Struggle for the better positions in new economies begins with intelligence.

Country's spatial inequality is currently being analyzed quite a lot; research on spatial restructuring is being conducted in latest scientific literature (for example, see [2, 5, 13, and 16]). In the World Bank Report [19] "Overcoming Spatial Inequality", spatial inequality refers to intraregional and interregional differences in a number of statistical indicators. A number of publications is devoted to Russian spatial development' various aspects, for example, papers by S. Rastvortseva [8], E. Kolomak [3], etc. For the last decade a new economic geography [1, 4, 15, and 17] can be being characterized as a spatial economy. Such a review is presented in papers by M. Fujita [12, 14].

Spatial imbalances elimination is perceived as an urgent task, however, there are many unexplained moments. Therefore, the discussion continues on some issues related to spatial regions' inequality and ways search for a new Russian market economy space assembly. The research goal is to study Russian spatial restructuring, both its current situation and conditions aimed at educational and innovation development in terms of new technological challenges and scientific/technological development strategy implementation in Russian regions.

## II. METHODS

Space development might be estimated via community's spatial dimension taking into account economic space transformation and digital economy development. Therefore in order to achieve this goal we'll apply the information approach. We take into account certain elements of territorial economic system which are inter-connected, but type of relations shall be determined by space geometry. We believe that there is a combination of the Shannon information approach and Boltzmann statistics, and we also believe that there is a phenomenological similarity between Boltzmann statistics equilibrium mechanisms and local equilibrium established as a result of agents' collective actions. In case we assume that there's a probability to choose messages, then its physical equivalent would be entropy. In case we apply negative entropy (neghentropy) that would mean that the community is able to overcome institutional and transactional restrictions in its attempt to achieve a leader (central) position.

Educational and innovation space study was carried out according to a number of indicators (Rosstat statistical data) characterizing highly qualified personnel training and innovative activity of Russian regions for the period 2010-2016.

## III. RESULTS

Education is one of the most important social benefits as well as basis for economic and innovative development. This thesis is emphasized in the "Education" national project setting the task of Russian education global competitiveness

and Russia's entry in top-10 countries in terms of general education quality around the world [6]. According to the Program “Digital Economy of the Russian Federation” human resources, education and innovations are the key elements for economy’s development [7]. At the same time according to some selected Russian regions’ indicators differentiation in terms of educational potential level is visible.

In order to evaluate how well a region is capable of qualified human resources reproducing, the Education Potential Index has been introduced. It was calculated using the neghentropy formula (in a sense of Boltzmann-Shannon approach) estimating local equilibrium probability in a new state while developing the modernization agenda as well as to characterize regions’ reciprocal values in transaction costs. A leader has a probability value equal to one, and an outsider is much less than the one. The reciprocal value is nothing but an increase in transaction costs.

Fig. 1 shows the Educational Potential Index calculations for federal districts and regions (only regions with a more significant Index’ indicators are presented). Educational "landscape" is therefore revealed.

We have also introduced the Innovative Potential Index in order to evaluate if the region is capable to proceed “from knowledge into practice” reproducing a competitive innovative economy and transaction costs reducing.

Fig. 2 presents Innovative Potential Index calculations for both federal districts and regions revealing thus an innovation “landscape”. Regions with rather high Innovative Potential Index’ indicators are presented.

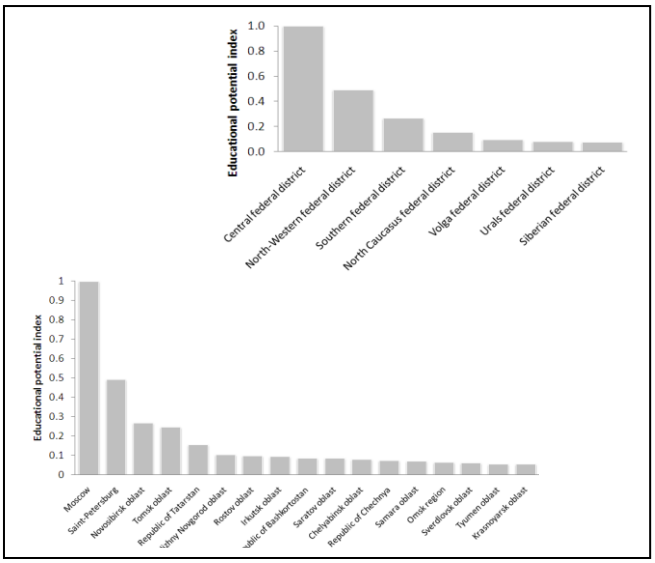


Fig. 1. Federal districts and regions distribution in Educational Potential Index

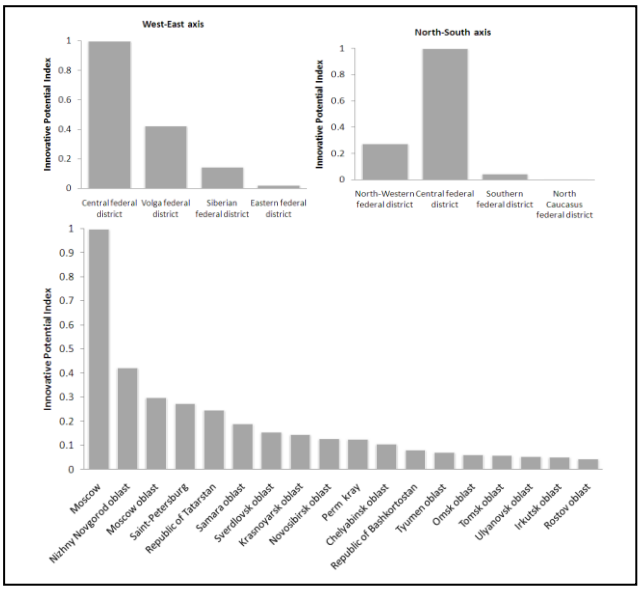


Fig. 2.Federal districts and regions distribution in Innovative Potential Index

Table 1 presents the first three clusters in terms of regions’ educational and innovative potential significance. The remaining regions constituted a cluster of educational and innovative outsiders. The reasons for regions’ more effective educational and innovative activity should be sought in explanation: who, where and how carries out educational activities.

TABLE I. THE FIRST THREE REGIONS CLUSTERS ACCORDING TO EDUCATIONAL AND INNOVATIVE DEVELOPMENT (GROUPED BY THE FUNCTIONS VALUES)

| I | II | III |
|---|---|---|
| Moscow<br>St.Petersburg | Republic of Tatarstan<br>Moskovskaya oblast<br>Nizhegorodskaya oblast | Sverdlovsdkaya oblast<br>Samarskaya oblast<br>Novosibirskaya oblast<br>Chelyabinskaya oblast<br>Krasnoyarsky kray<br>Republic of Bashkostostan<br>Permsky kray<br>Tomskaya oblast<br>Rostovskaya oblast<br>Tymenskaya oblast<br>Saratovskaya oblast<br>Krasnodarskykray<br>Voronezhskaya oblast<br>Irkutskaya oblast |

As a result, a geo-economic invariant is finally outlined – both a developed innovation center and lagging periphery. First of all, Moscow stands apart since it can fully provide information and legal support for the entire chain “from knowledge into practice” as well as create a portfolio to an innovative product and required number of human resources. In addition we notice a small group of regions (St. Petersburg and regions from the second cluster) with quite high engineering activity able to provide legal and organizational support for a new innovative product. Furthermore, as the rating decreases, constraints (primarily institutional one) do increase sharply.

## IV. CONCLUSION

Geography of transboundary knowledge flows depends on a number of institutional factors. Both leaders and periphery observe a different institutions' quality when dealing with educational and innovation processes. The reason for that is periphery's legal, informational and digital discrimination imposed by extractive market institutions leading to economic rent's loss and consequently to endogenous sources of development. Developed entities in accordance with the chosen strategy strive to become licensors via providing a ready-made technologies, information products and services for highly intellectual rent (royalties) to peripheral licensees (case of academic degree holders, for example). The periphery is being discriminated and subordinate to the center which has more skills, sets its standards etc.

Government's influence is highly necessary in order to enhance intellectual potential concentration and to benefit from knowledge economy. In this case it will be possible to create favorable prerequisites for intellectual potential concentration and its transformation into a space synergy.

Contemporary education and science internationalization is unfolding digital economy active development. There is a replacement of people physical movement by messages movement. Through this online information exchange a collective model of educational and innovation process is facilitated. However an appropriate infrastructure is also necessary. Contemporary Russian internal problems related to science under financing and insufficient level of supporting infrastructure seriously increase systemic risks in current modernization agenda

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