26th ERSA Summer School 2013
Innovation, Entrepreneurship and Development of Regions of Varying Density
1-8 July 2013, Karlskrona, Sweden

Assessment of regional innovation potential in Russia

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Object, hypothesis, purpose

- **Object** – innovation space of Russia, its territorial structure and dynamics (in terms of innovation potential)

- **Hypothesis** – Russian innovation space has a relatively stable structure, despite negative trends of decreasing density. This structure corresponds to global trends and laws, but it has features of territorial organization inherited from the Soviet period

- **Purpose** – to identify regions with the highest potential, where support of innovation activities would be the most effective

Structure

I. Theoretical background

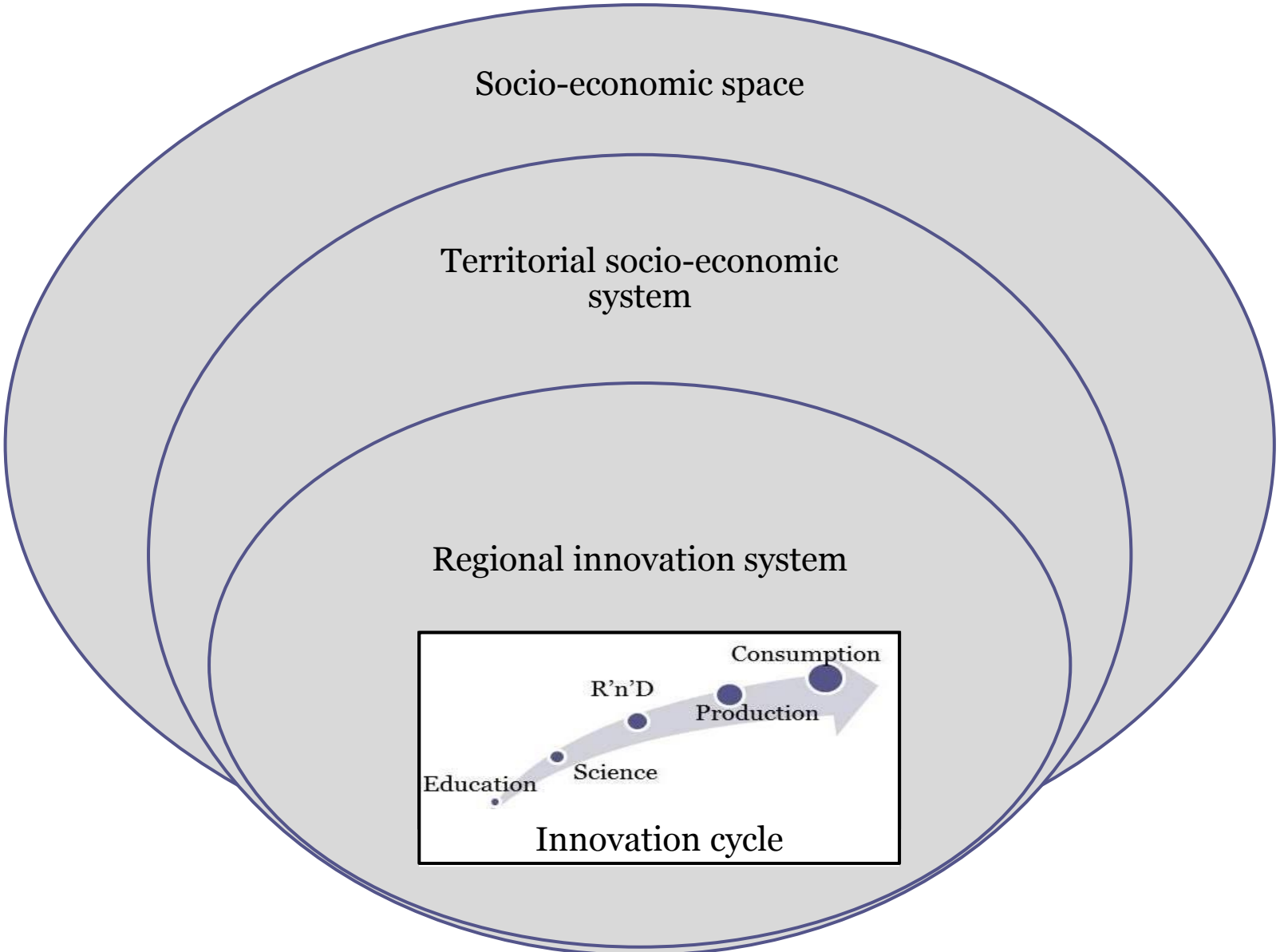
II. Generation of innovation (assessment of innovation potential)

III. Diffusion of innovation (assessment of innovativeness)

IV. Regional innovation clusters (assessment of potential and territorial priorities)

V. Conclusion

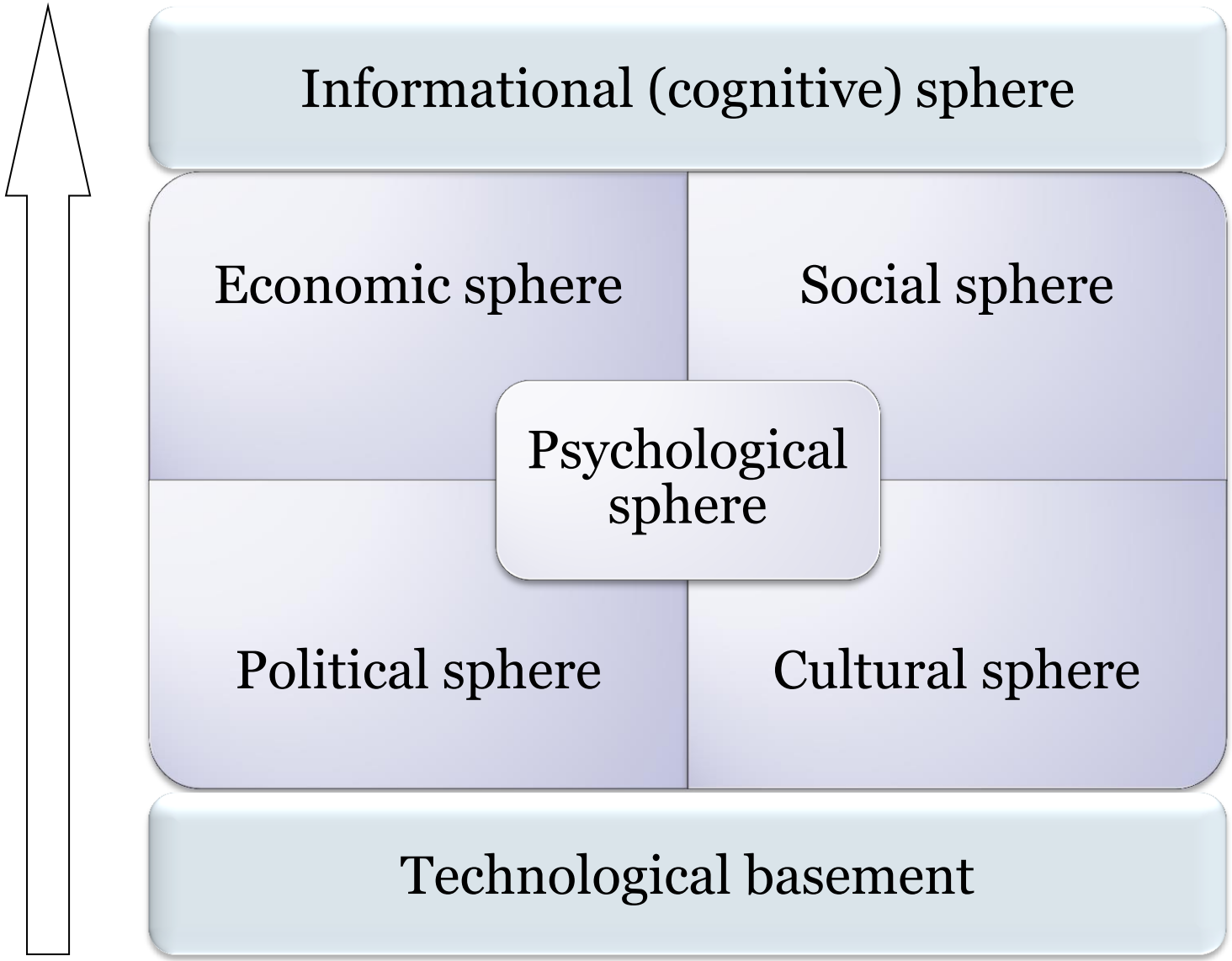
I.1. Conceptual framework



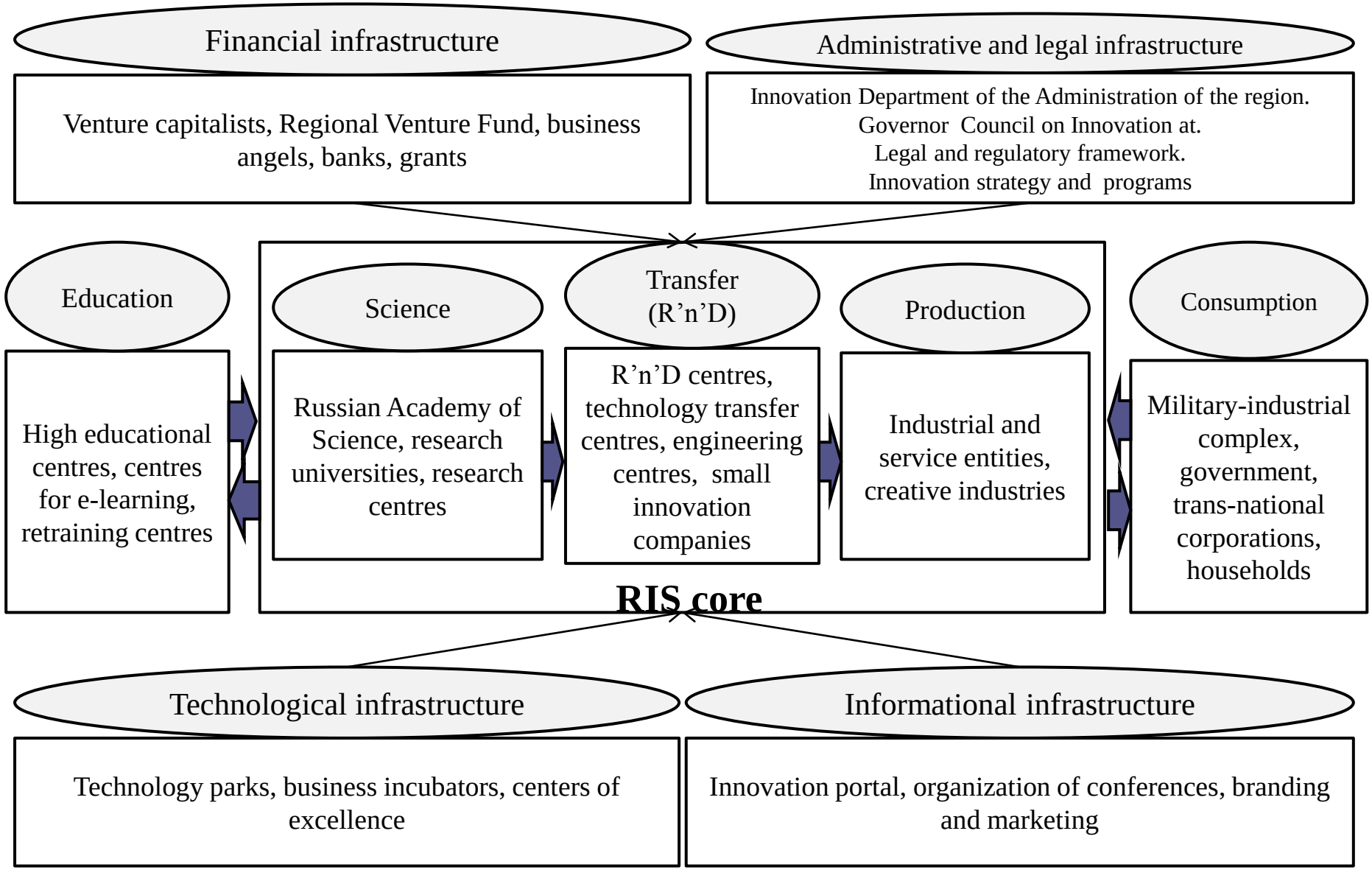
I.2. Terminology

- **Innovation cycle** - institutionalized process of transition from ‘idea generation’ stage to the stage of ‘commercial product’ and ‘consumption’
- **Social economic space (SESP)** - general conditions of the region, especially its economic-geographical position
- **Territorial social-economic system (TSES)** - a set of interrelated technologies, people, organizations, institutions and ideas in a certain area
- **Regional innovation system (RIS)** - infrastructural, institutional and organizational embodiment of innovation cycle stages

I.3. Scheme of territorial social-economic system

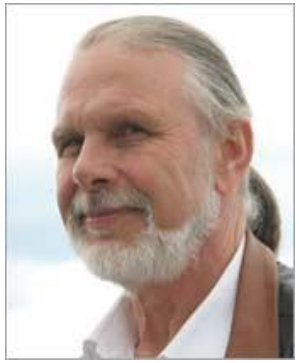


I.4. Scheme of RIS (based on innovation cycle)



I.5. Generation of innovation

National innovation system



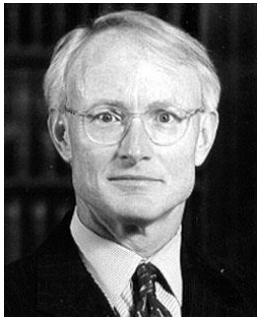
Bengt-Åke Lundvall
(1941 - ...)

Richard Nelson
(1930 - ...)

Regional innovation system

Bjørn Asheim
(1948 - ...)

Cluster



Mickael Porter
(1941 - ...)

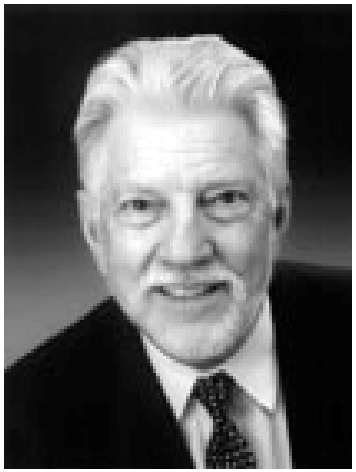
Creative class

Richard Florida
(1957 - ...)

I.6. Diffusion and transfer of innovation

Social science

Diffusion of innovation *(Diffusion of innovation, 1962)*



Everett Rogers
(1931 – 2004)

Technology transfer *(Technological forecasting in perspective, 1967).*

Erich Jantsch
(1929 – 1980)

Spatial science

Spatial diffusion *(Innovation diffusion as a spatial process, 1953)*

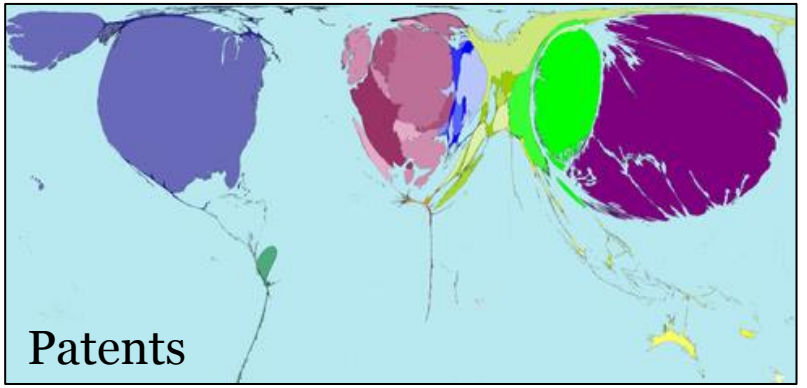
Torsten Hägerstrand
(1916 – 2004)

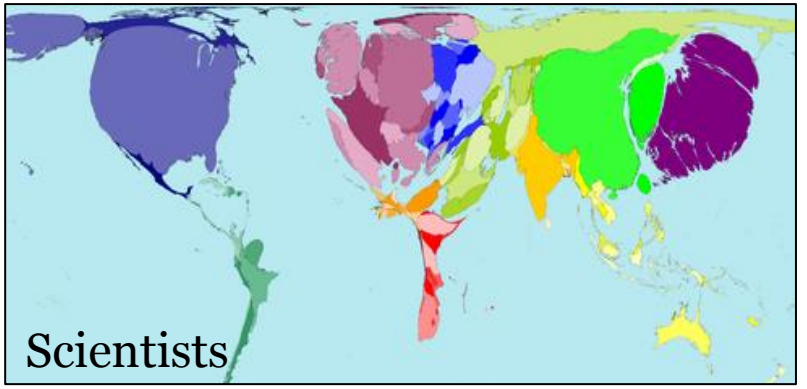
Core-periphery *(Regional Development Policy, 1967)*

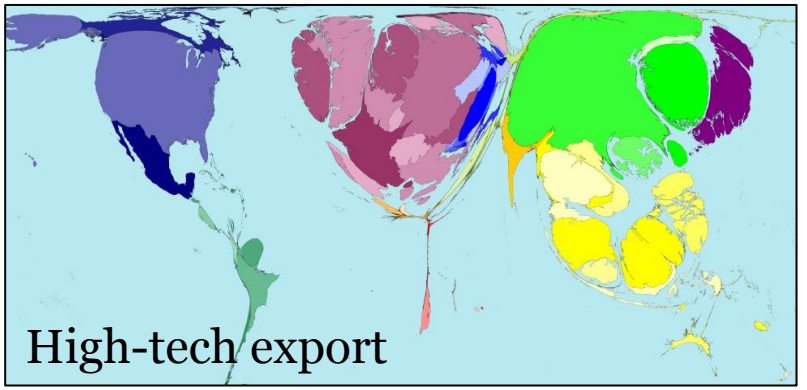
John Friedman
(1926 - …)

II.1. Russian national innovation system

Index	Russian position in 2009	Number of countries
Innovation Index WB	41	145
Innovation Capacity Index	49	130
Global Innovation Index INSEAD	68	130
Innovation Index WEF	73	133







II.2. Patent activity as a main indicator of innovation space

Equation of **potential field** (gravity model)

$$V_j = P_j + \sum P_i / D_{ji}$$

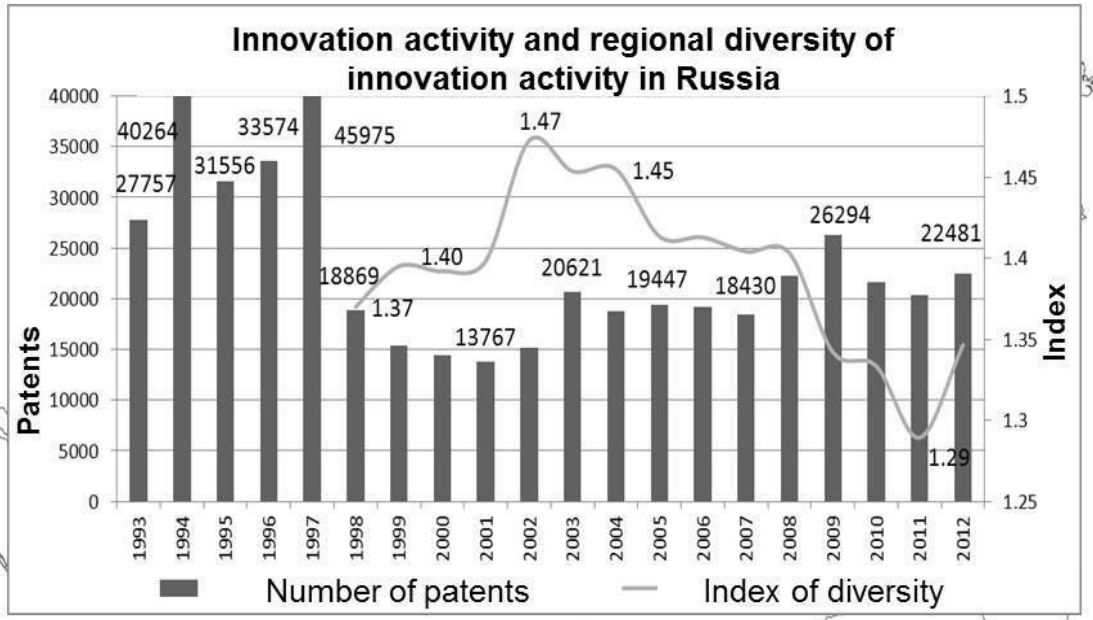
where P_j is a value of an indicator (number of granted patents per 100 000 urban citizens) in point j, P_i is a value of the indicator in a point i; D_{ji} is a distance from a point j to a point i, km.

Equation for **territorial diversity** of innovation activity between regions (Shannon entropy):

$$E = \sum S_i \times \log(1/S_i)$$

where S_i - a percentage of granted patents in a region i of the total number of granted patents in Russia.

Innovation potential and activity in Russia from 1989 to 2012



Potential of patent field in 1989 and 2010

Density of patent field in 2010 (patent / 100 th. urban citizens)

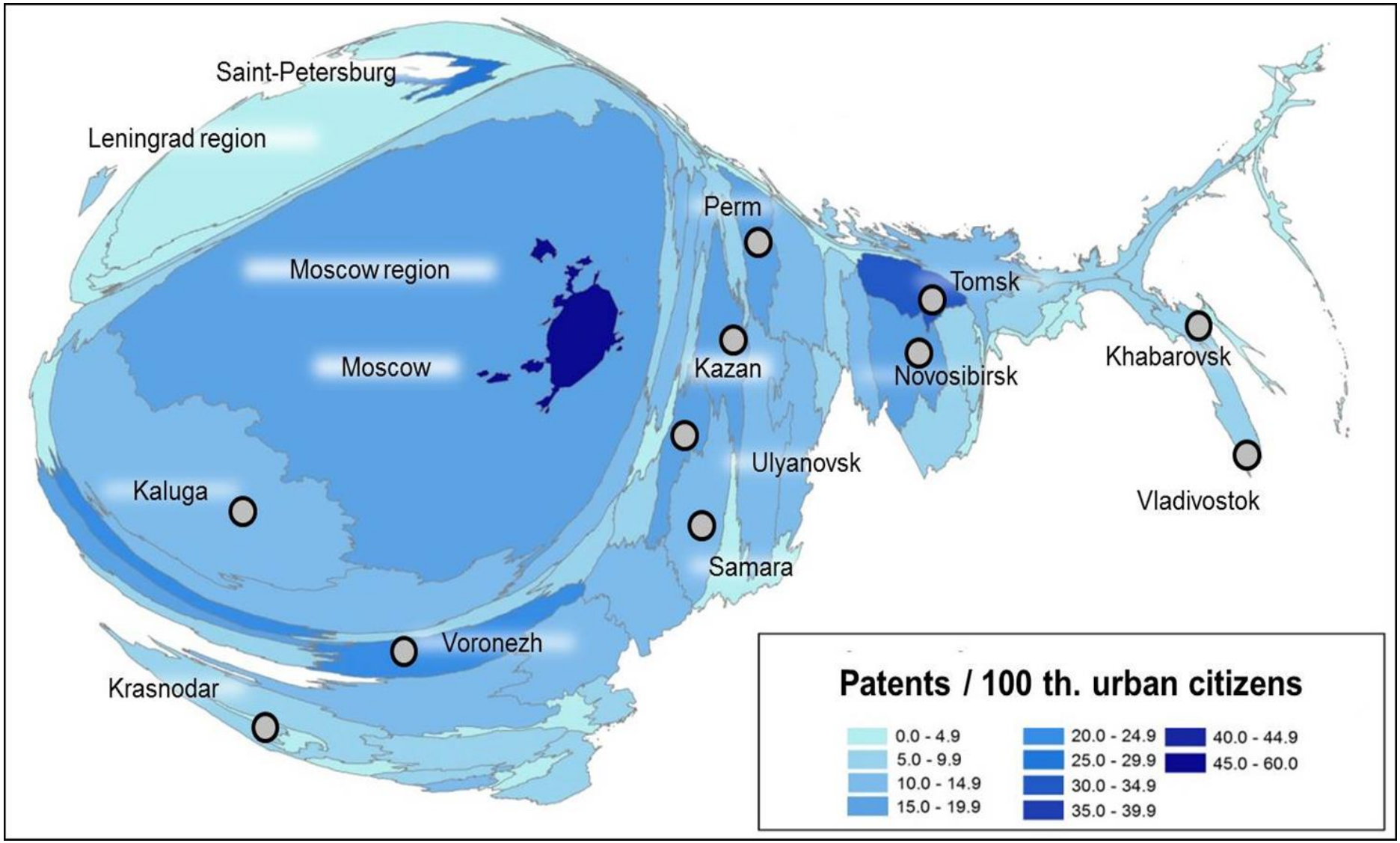
0 5 10 15 20 25

20 — Density of patent field in 1989 (patent / 100 th. urban citizens)

Perm — Innovation centres in 2010 r. (> 20 patent / 100 th. urban citizens)

Tomsk — Largest innovation centres in 2010 r. (> 30 patent / 100 th. urban citizens)

II.4. Concentration of innovation activity



II.5. Creative potential (index of creativity) (according to R. Florida, A. Pilyasov)

1. **Subindex of talent:**
- human capital (percentage of employees with higher education, %)
- scientific talent (number of researchers per 1 million inhabitants)

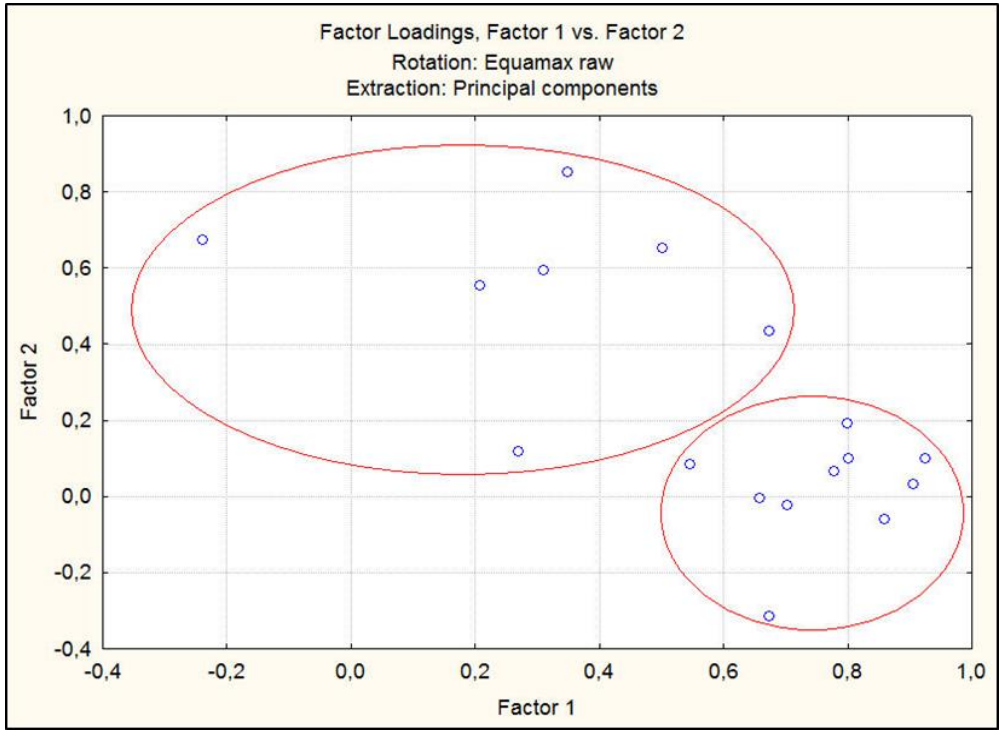
2. **Subindex of technology:**
- science investment (R & D expenditure per GRP, %)
- patent activity (number of patents granted per million inhabitants)

3. **Subindex of tolerance:**
- ethnical diversity (percentage of households, where members are of different ethnic group, %)
- international attractiveness (percentage of migrants from outside Russia in total arrivals, %; number of migrants per 10 thousand inhabitants)

II.6. Clusters of regions by creativity index

II.7. Factor analysis

- 38 indicators, based on expert interviews and existing literature, were divided by SESP, TSES and RIS subcategories
- Factor, correlation and normal distribution analysis
- Each indicator either increases the probability of innovation generation, or an indicator of innovation activity itself



Socio-economic space	1.1. Economic-geographical position (capital, agglomeration, coastal area)
	1.2. Population density
	1.3. Percentage of urban citizens (urabnization)
	1.4. Percentage of population in cities with more than 200 th. people
Territorial socio-economic system	**Technological sphere**
	2.1. Percentage of ICT expenditure in GDP
	2.2. Computers per capita
	2.3. Computers with Internet per capita
	2.4. Percentage of organizations with web-site
	2.5. Percentage of organizations with special programs
	Economic sphere
	3. GDP per capita
	Social sphere
	4.1. Percentage of people with high education
	4.2. Migration per capita
	4.3. Percentage of foreign migrants
	Cultural sphere
	5.1. Percentage of households, where members are of different ethnic group
	Informational sphere
	6.1. Percentage of Internet users
Regional innovation system	**Education**
	7.1. Number of university students per capita
	Science
	8.1. Number of scientists per capita
	8.2. Number of registered patents per 1000 employees
	Transfer (R'n'D)
	9.1. Percentage of employees in R & D sector in total employment
	9.2. Percentage of R'n'D expenditure in GDP
	9.3. Percentage of R'n'D organizations
	Production
	10.1. Percentage of technological innovations expenditure in GDP
	10.2. Number of new technologies per 1000 employees
	10.3. Percentage of innovation active organizations
	10.4. Innovative production percentage in total production
	Consumption
	11.1. Service access to information via the Internet, GB per year, per urban citizen

II.9. Index of innovation potential

The first factor (Index of absorption): urbanization (%), computers with Internet access per 100 employees, GDP per capita, percentage of multinational families (%), percentage of Internet-users (%), and mobile phones per capita.

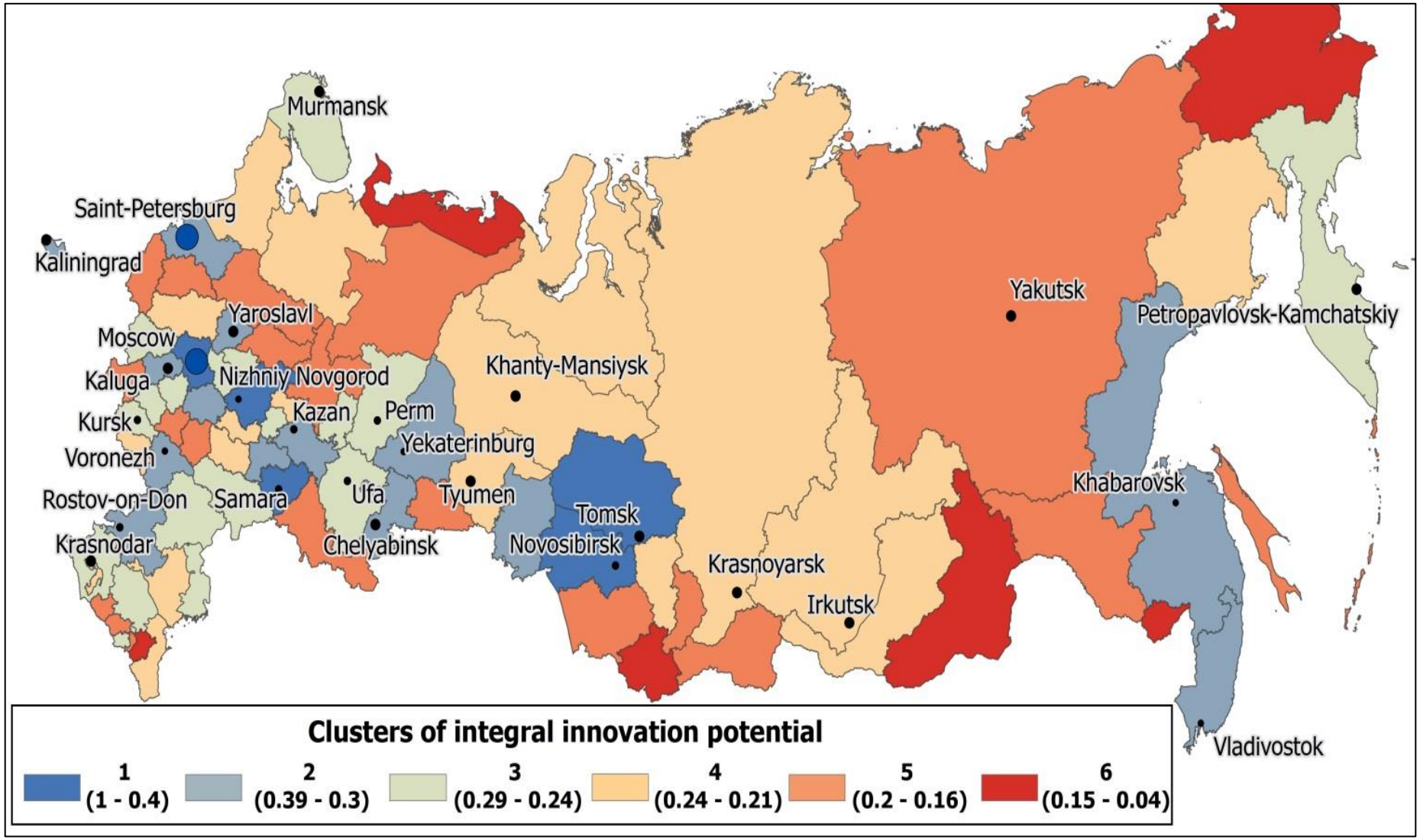
The second factor (**Index of innovation potential**):

SESP:
- economic-geographical position (points)

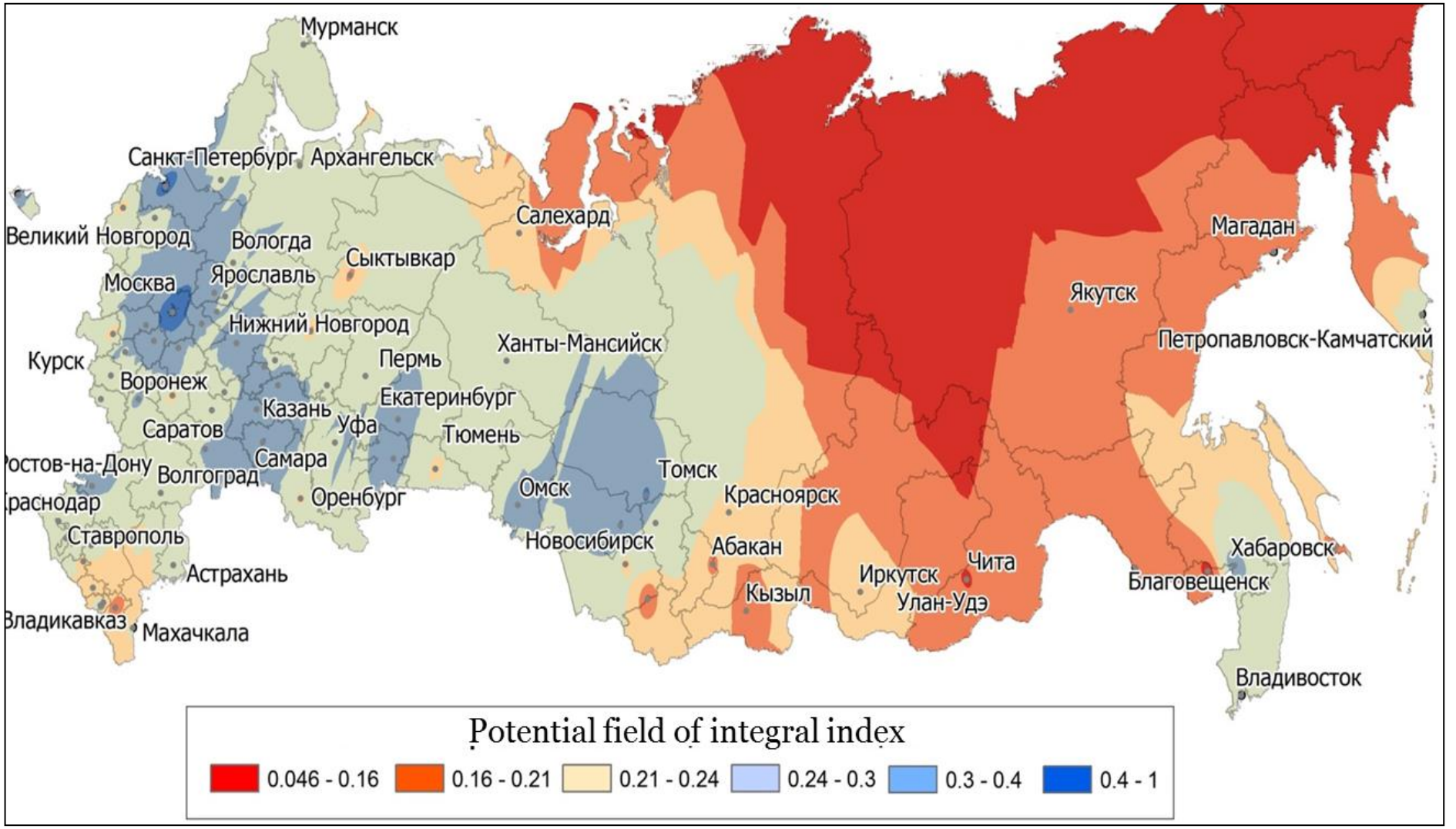
TSES:
- percentage of residents in cities with population more than 200 thousand people (%)
- percentage of people with a higher education in the population (%)

RIS:
- number of university students per 10 thousand people
- percentage of employees in R & D sector in total employment (%)
- number of registered patents per 1000 employees
- percentage of organizations with a website (%)

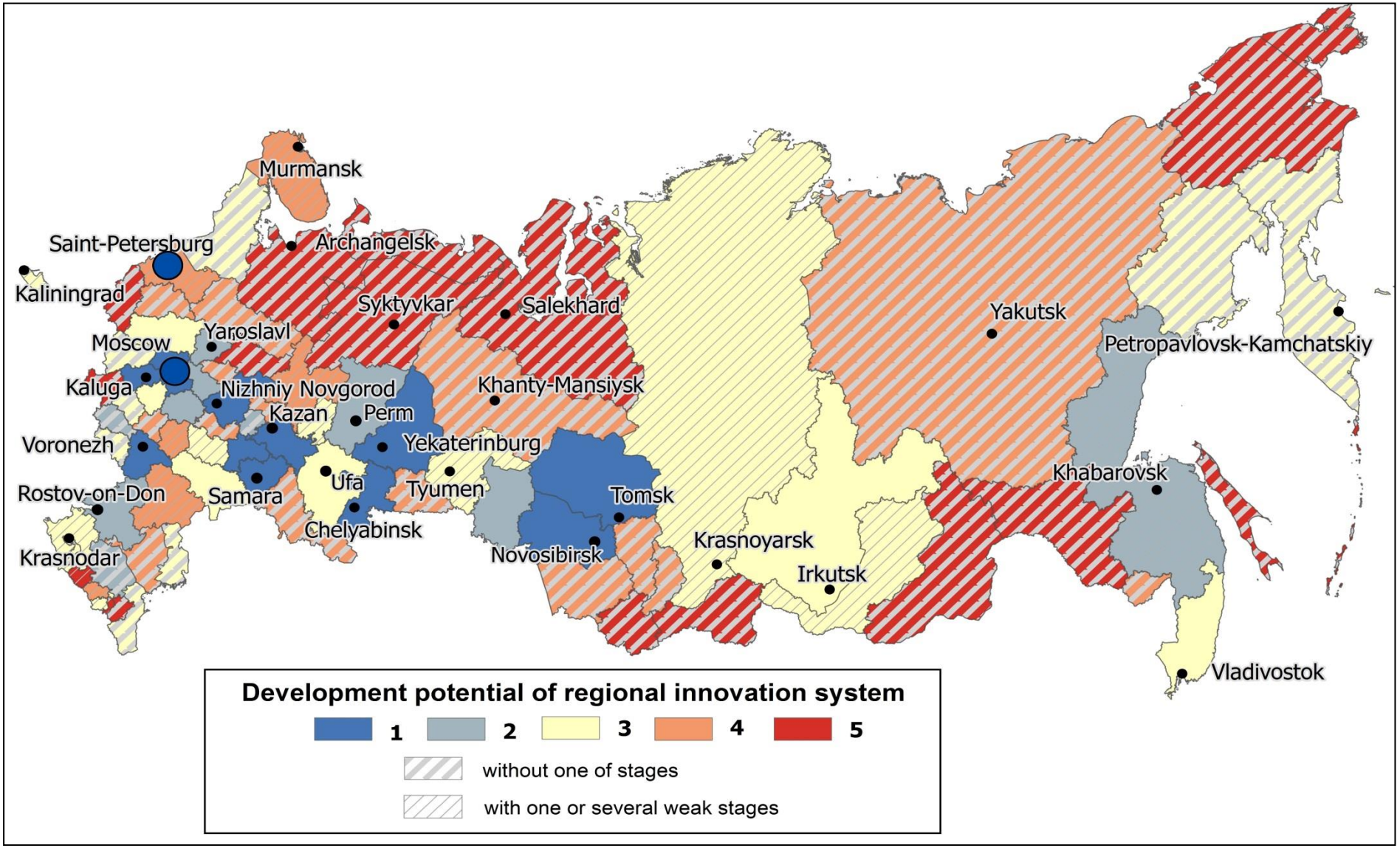
II.10. Clusters of integral innovation potential



II.11. Potential field of integral index

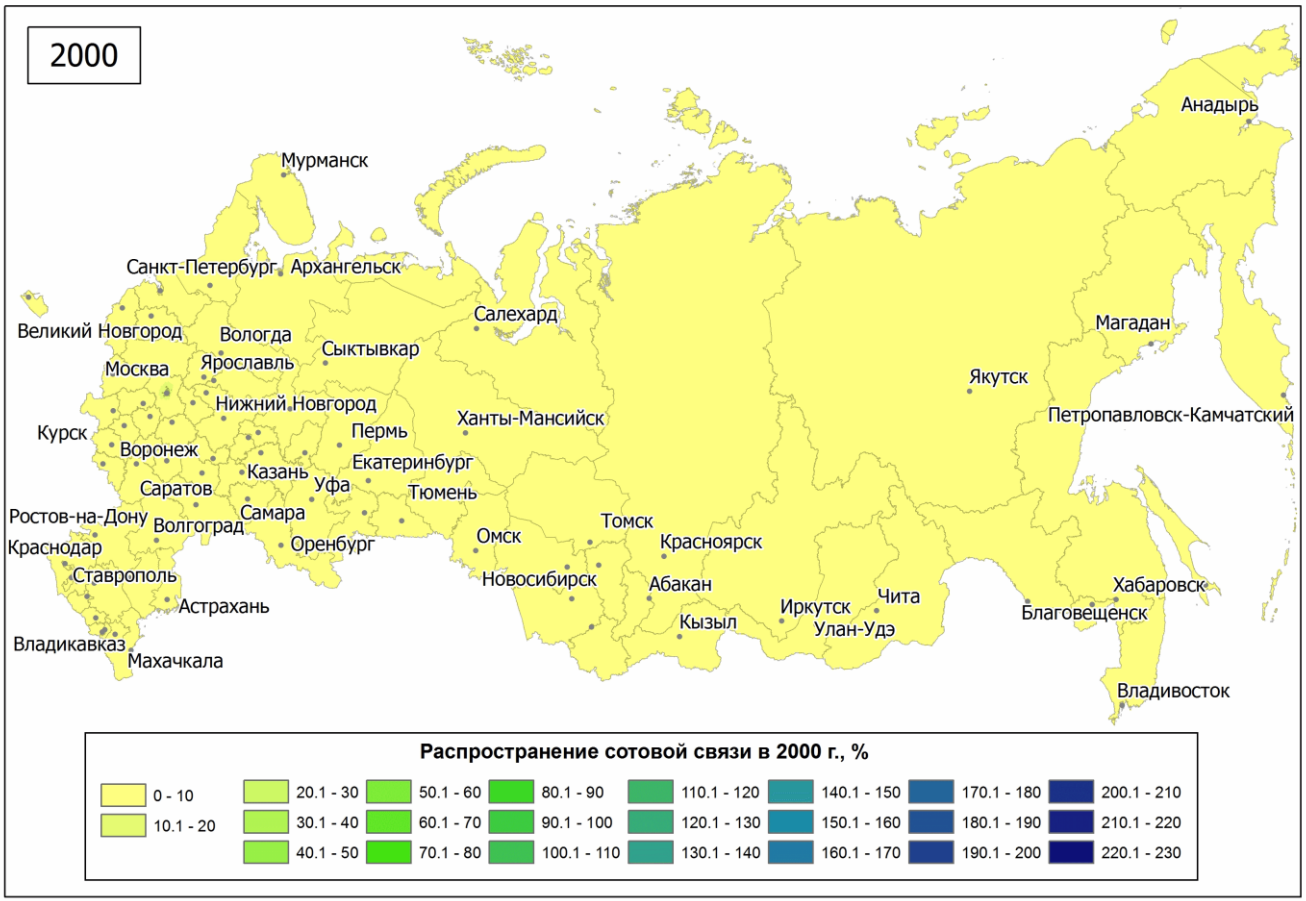


II.12. Assessment of development potential of regional innovation systems

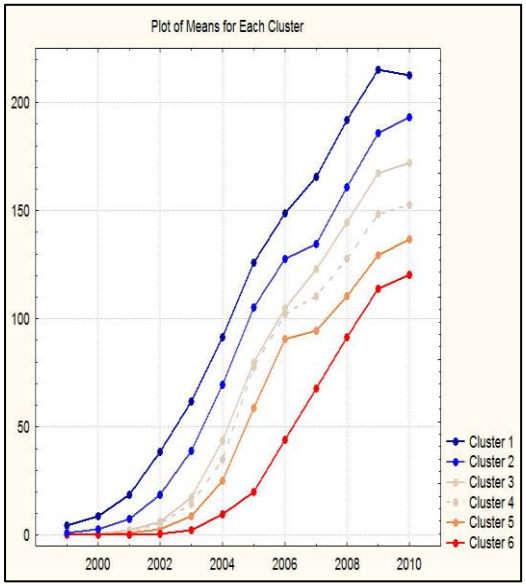


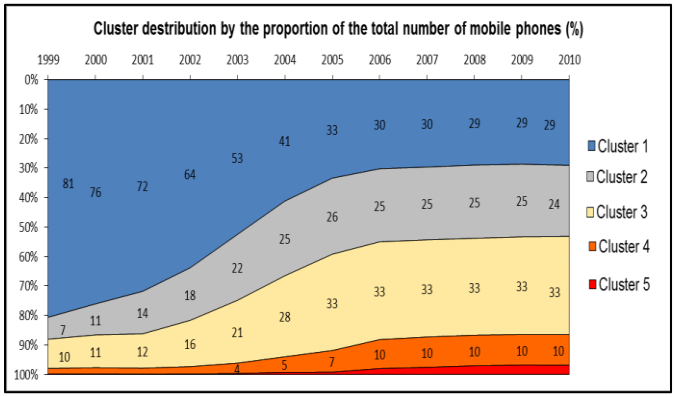
III.1. Spatial diffusion of innovation

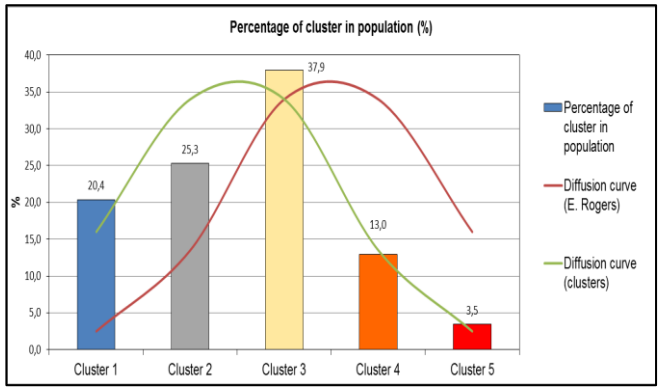
Mobile phones usage, or subscriptions (active SIM cards per 100 people) per capita

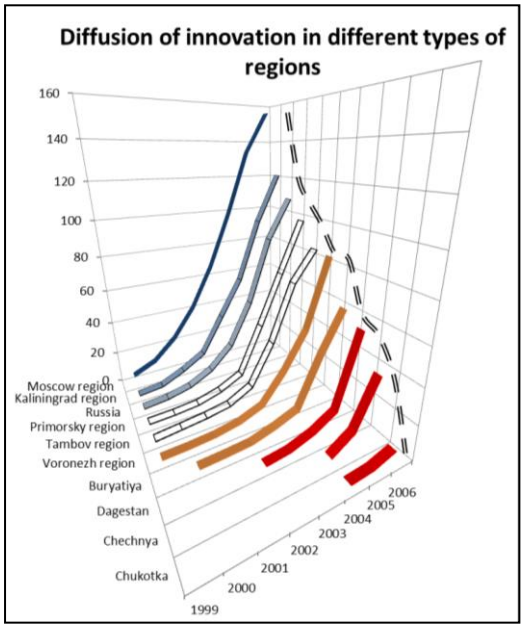


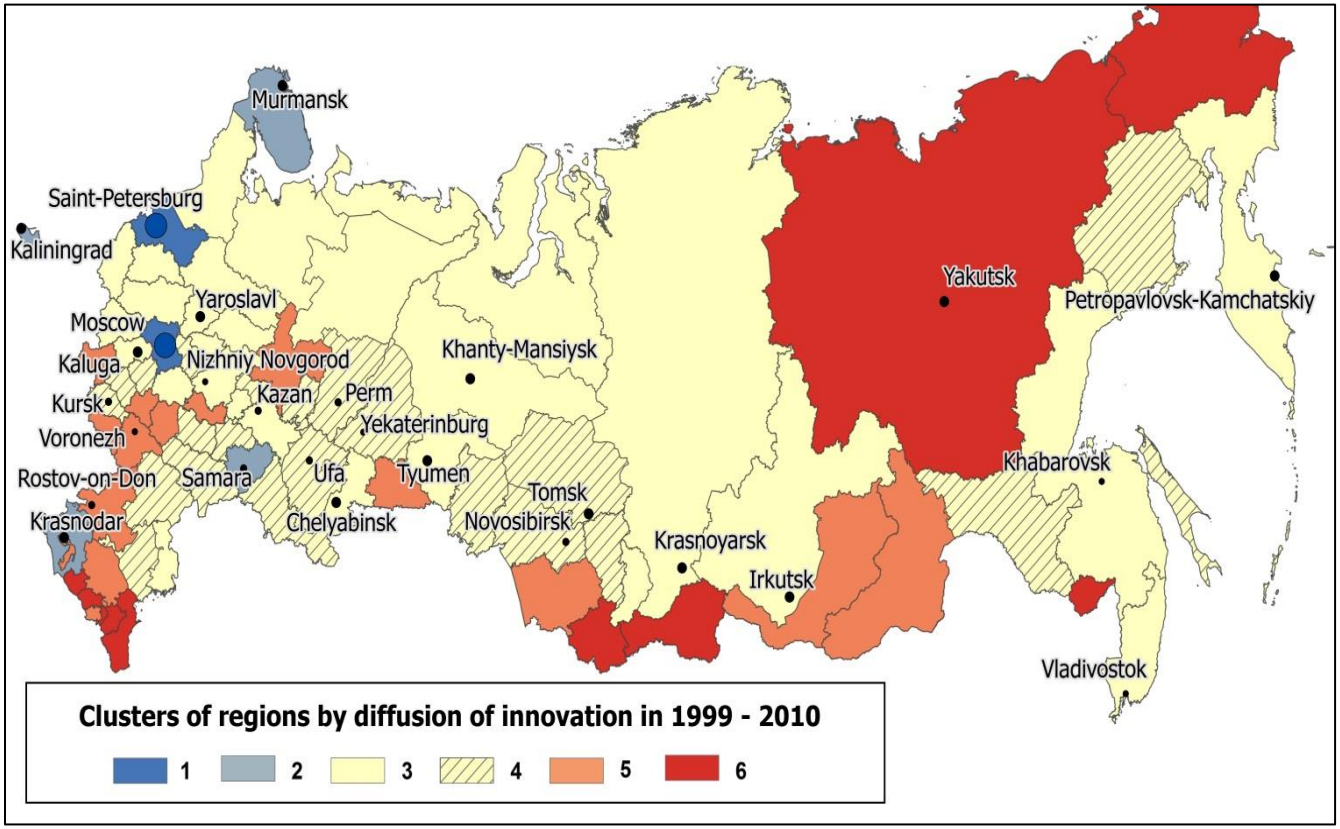
III.2. Clusters by diffusion of innovation





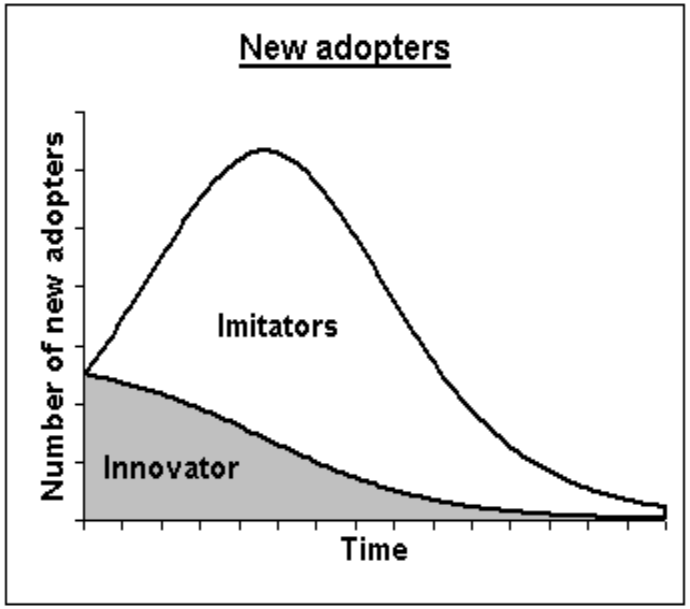






III.3. Bass model (Bass, 1969)

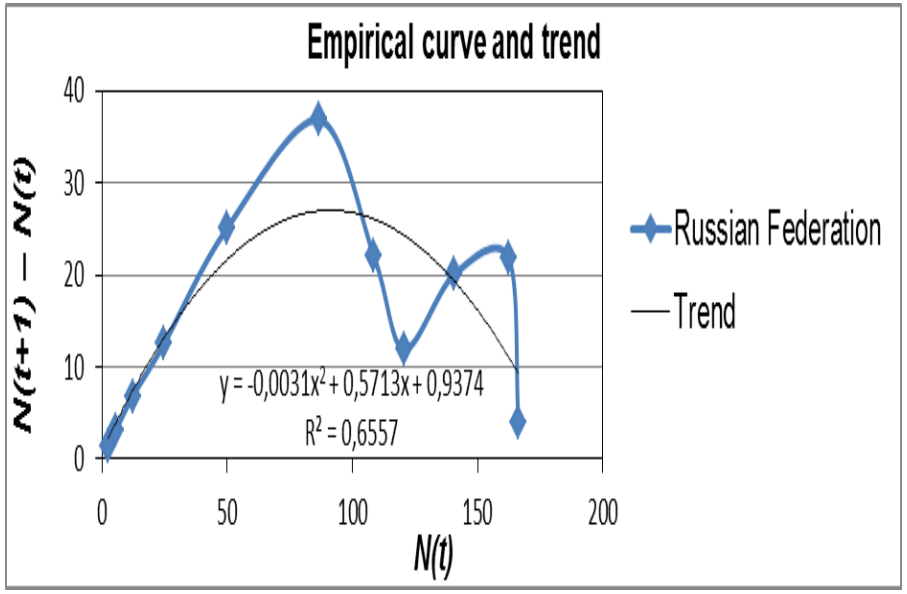
Bass considered a population of N_{max} individuals who are both **innovator**s (those with a constant propensity to purchase, ***a***) and **imitators** (those whose propensity to purchase is influenced by the amount of previous adopters, ***b***) in so-called mixed-influence model The model can be rewritten from original differential form in terms of its discrete analogue

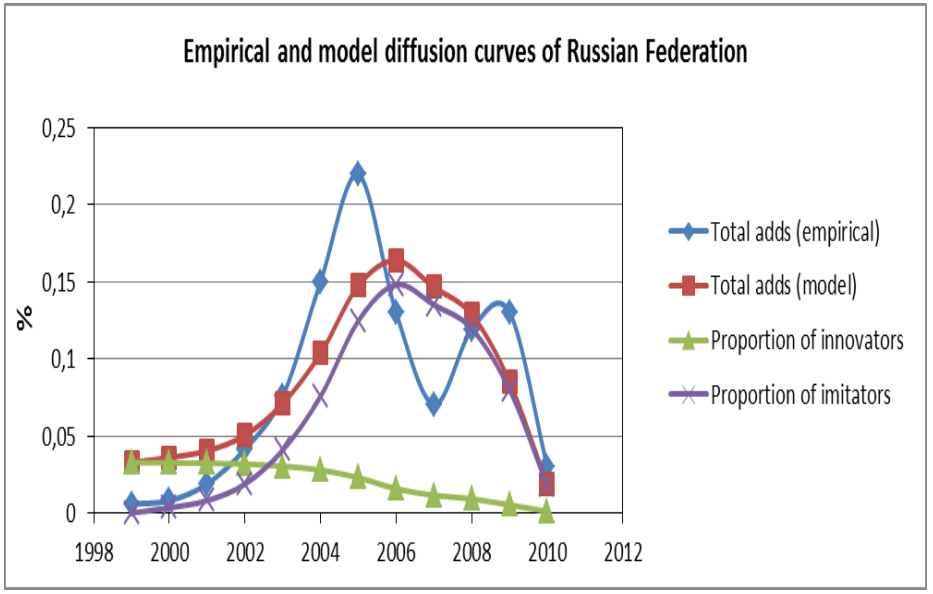


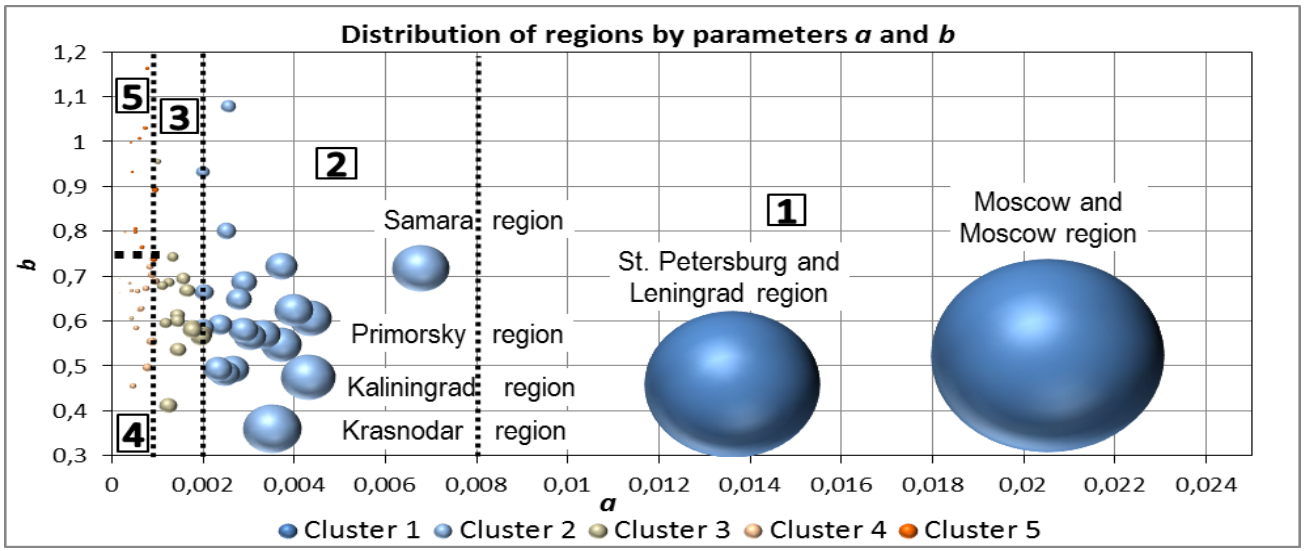
$$N(t+1) - N(t) = a*N_{max} + (b*N_{max} - a)*N(t) - b*N(t)^2 = A_1 + A_2*N(t) + A_3*N(t)^2 + e(t)$$

where $a = A_1/N_{max}$, $b = -A_3*N_{max}$, $N_{max} = (-A_2 \pm \sqrt{(A_2^2 - 4*A_1*A_3)})/2*A_3)$

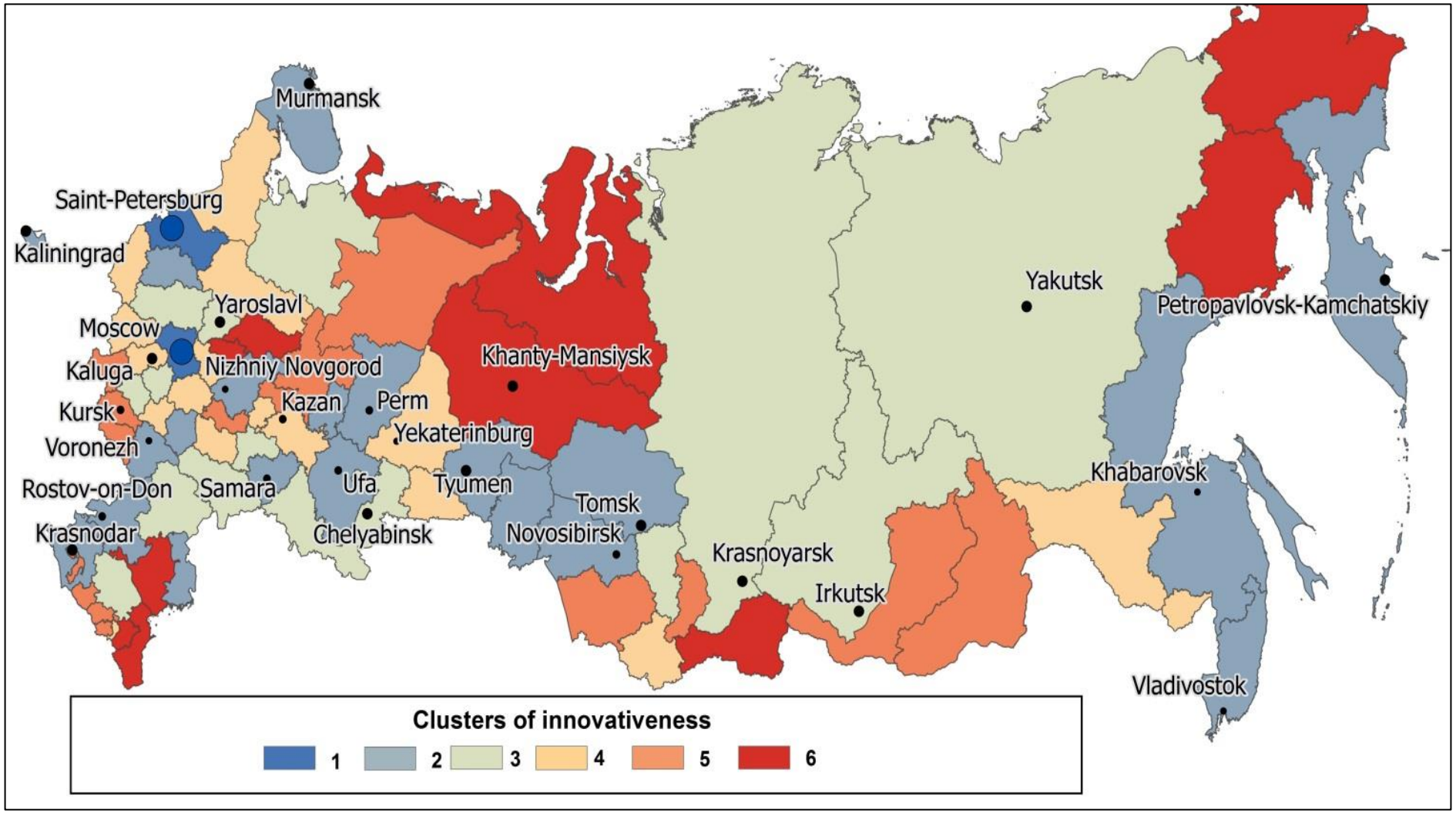
III.4. Estimation of *a* and *b*



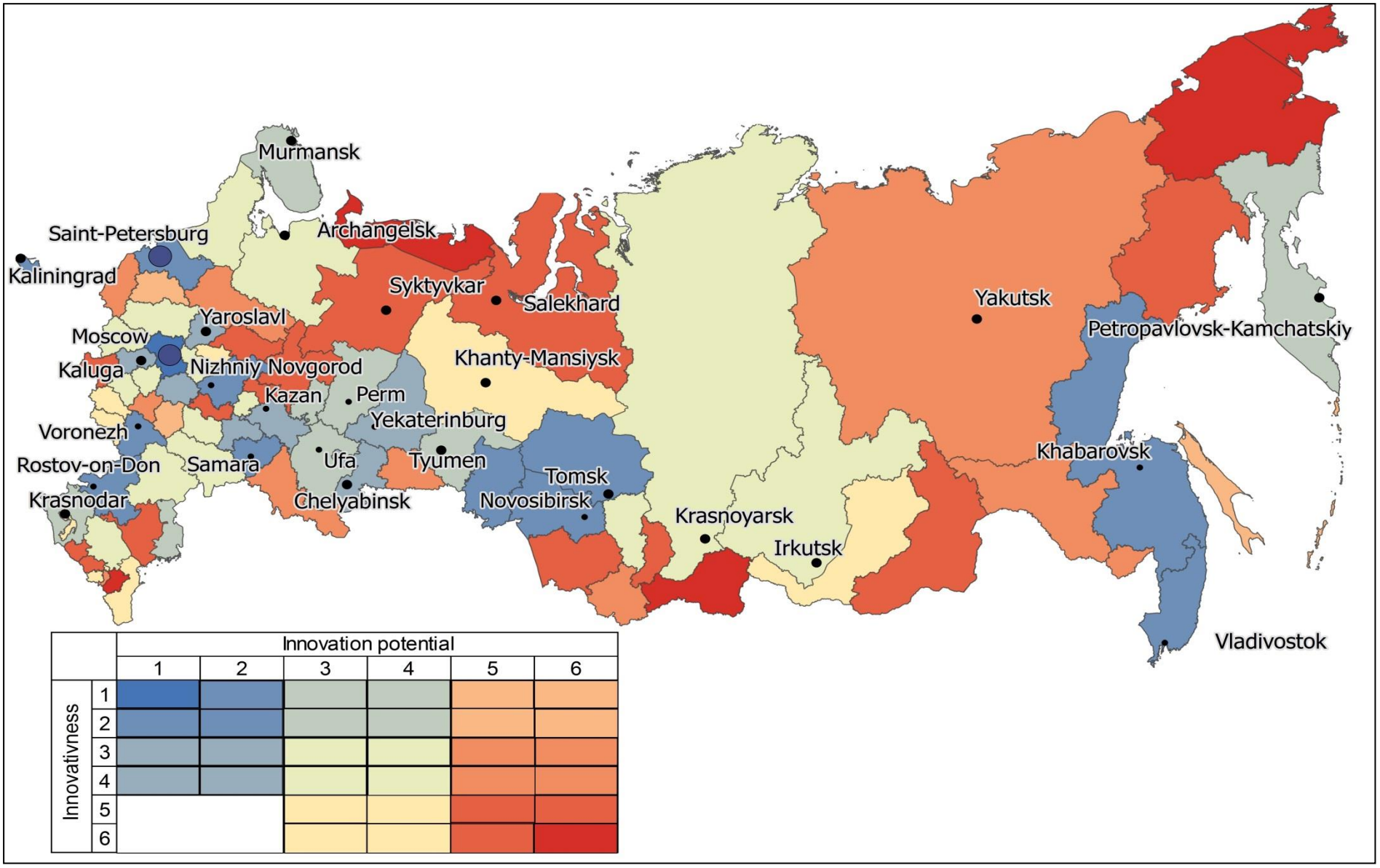




III.5. Innovativeness



III.6. Priorities for regional innovation policy



IV.1. Regional innovation clusters in ‘Environmental management’

130 organizations: two universities – forecasting centres and 12 universities – members of the network, interacting with outside universities (12 organizations), research organizations (42) and entities (62)

The index of competence (I_{KMP})

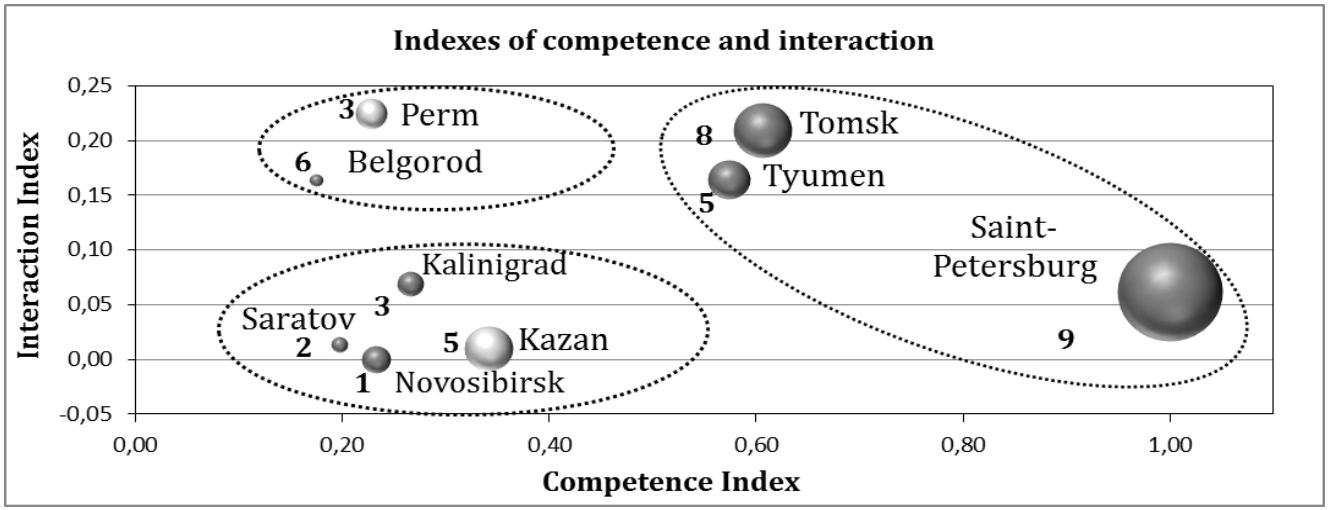
$$I_{KMP} = (I_C + (I_{NT} \times I_{VTZ}))$$

where I_C – subindex of the number of university competencies, I_{NT} – subindex of new technologies, I_{VTZ} – subindex of transfer centres

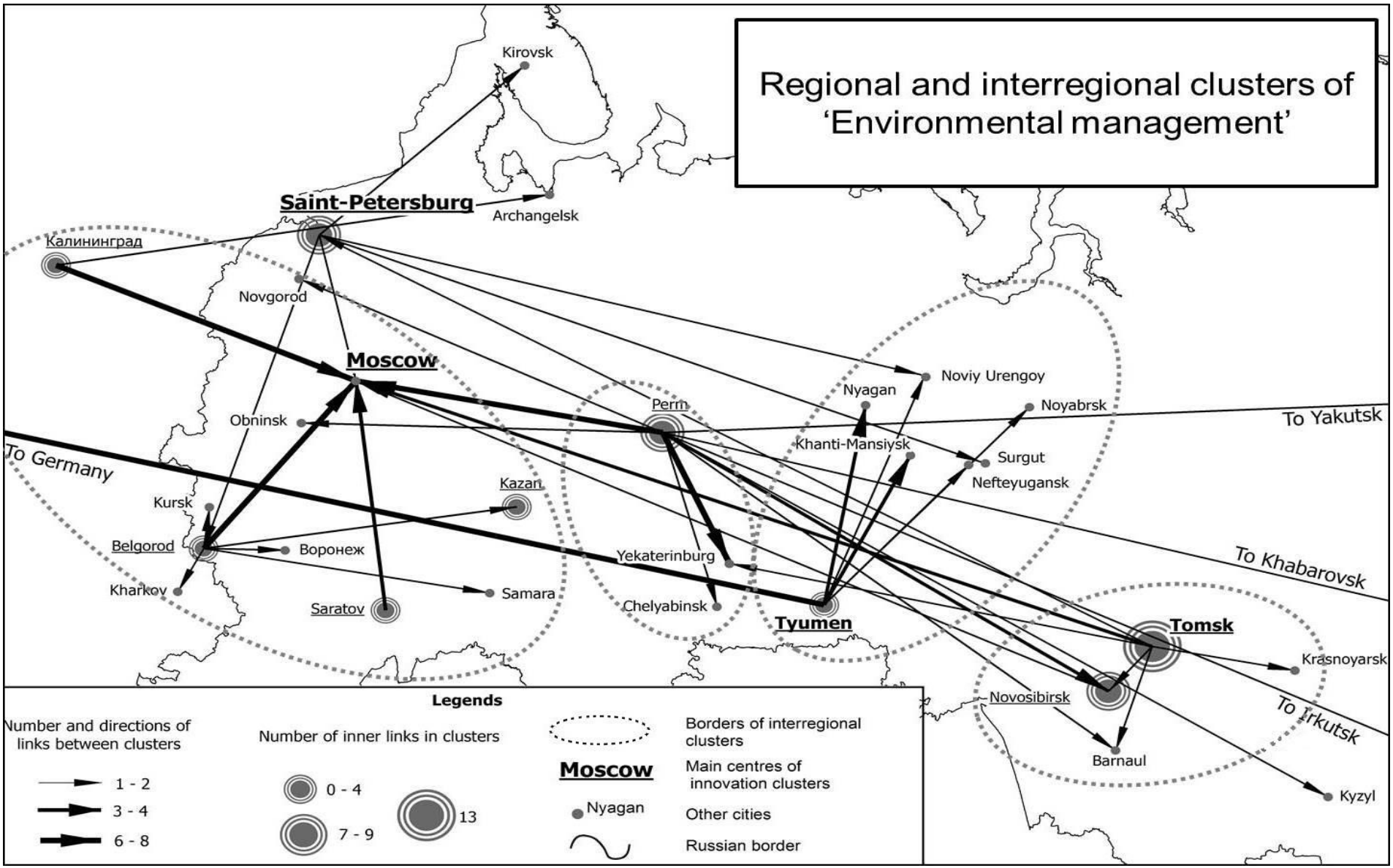
The index of interaction(I_{VZ})

$$I_{VZ} = I_{SV} \times I_{TR} \times I_{SR},$$

where I_{SV} – subindex of the number of associated organization (or interactions), I_{TR} – Shannon index of the share of connections between different cities, I_{SR} – Shannon index of the share of organizations of different stages of the innovation cycle.



IV.2. Regional and interregional innovation clusters in ‘Environmental management’



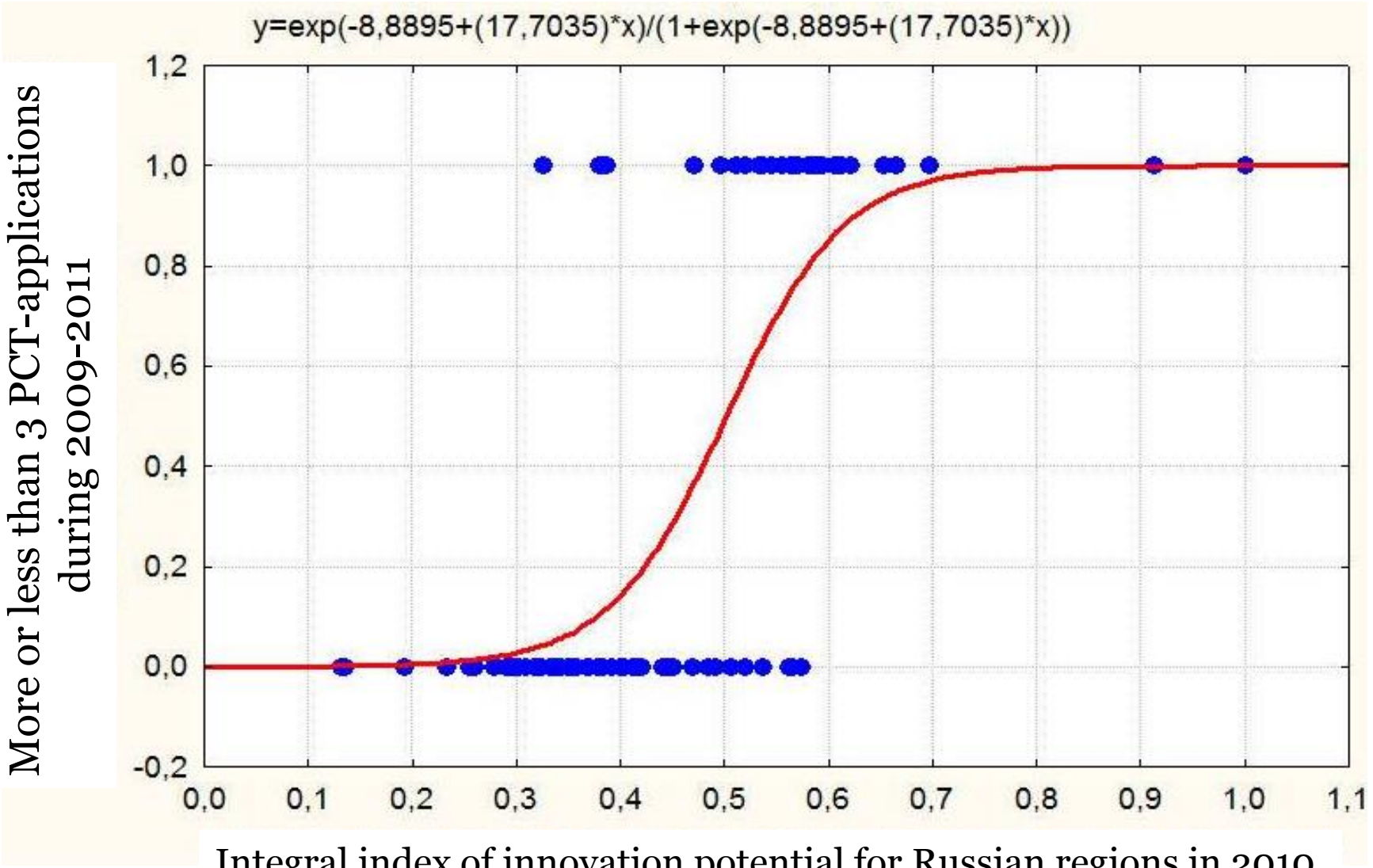
V. Conclusion

- Russian innovation space can be described by **core-periphery model**: the largest cities are the centres for generation and diffusion of innovation on the northern and southern agrarian peripheries.
- After the collapse of the Soviet Union the innovation space was divided into a number of **isolated and poorly connected centres**, concentration increased, variety of functions declined, and "lifeless" periphery was formed. These negative processes have not been overcome, despite the economic achievements of the 2000s.
- **Hierarchical model of diffusion** from the main centres to secondary prevails in Russia. Factor of **geographical location** (borderlands and seaside location) also play a crucial role. At the initial stage, many regions have similar level of saturation (parameter $\boldsymbol{a}$), but further absorption stops in the northern regions due to the low population density, and in the southern regions because of agricultural specialization and high institutional barriers.
- **High correlation** between the territorial structure of urban settlements, innovation potential of cities and new innovation centres was identified. The territorial structure and the potential of the clusters indicate the possible direction of the shift of innovative activity.

References

- Asheim B., Isaksen A. Regional innovation systems: the integration of local 'sticky' and global 'ubiquitous' knowledge // Journal of technology transfer, vol. 27, issue 1, 2002. – pp. 77-86.
- Baburin V. Innovation cycles in the Russian economy. Moscow, 2010 (in Russian).
- Baburin V., Zemtsov S. Innovation geography of Russia. 2012 International Conference on Research Challenges in Social and Human Sciences, South Korea, 2012.
- Bass F. A new product growth model for consumer durables. Management Science 15 (5): p. 215–227. 1969.
- Doloreux D., Parto, S. Regional innovation systems: Current discourse and unresolved issues. United Nations University, Institute for New Technologies, 2005.
- Fagerberg, J., Srholec, M. National innovation systems, capabilities and economic development, TIK Working Paper on Innovation Studies No. 20071024, Oslo. 2007.
- Florida Richard. The Rise of the Creative Class. And How It's transforming Work, Leisure, Community and Everyday Life. New York: Basic Books, 2002.
- Gastner M, Newman M. Diffusion-Based Method for Producing Density Equalizing Maps. Proc. Natl. Acad. Sci. USA 101, 2004.
- Hagerstrand T. Innovation Diffusion as a Spatial Process. Chicago. 1967.
- Isard, Walter. Introduction to Regional Science. New York: Prentice Hall. 1975
- Jantsch E. Technological forecasting in perspective, OECD, 1967.
- Krugman P., Fujita M., Venables A. The Spatial Economy: Cities, Regions, and International Trade. Cambridge, MA: MIT Press, 1999.
- Lundvall B. National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning. London, Pinter, 1992.
- Mahajan V., Peterson R. Models for Innovation Diffusion (Quantitative Applications in the Social Sciences). Sage university paper, 1985.
- Meade N., Islam T. Modelling and forecasting the diffusion of innovation – a 25-year review. International Journal of Forecasting, 2006, 22. 514 – 545 p.
- Pilyasov A., Kolesnikova O. Evaluation of creativity of Russian regional communities // Voprosy Economiki. 2008. Number 9. P.50-69 (in Russian).
- Rogers, E. Diffusion of Innovations. New York: Free Press. 1965.
- Zubarevich N., Safronov S. Russian regions: what social space we live in // Institute for Social Policy –Moscow: Pomatur, 2005 (in Russian).

Thank you for your attention!
Спасибо за внимание!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More or less than 3 PCT-applications during 2009-2011
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Integral index of innovation potential for Russian regions in 2010