16th GCBSS-2024 Conference – Kuala Lumpur

Methodology to Analyze
the Resource Potential of Innovative Clusters
in the Context of SDGs

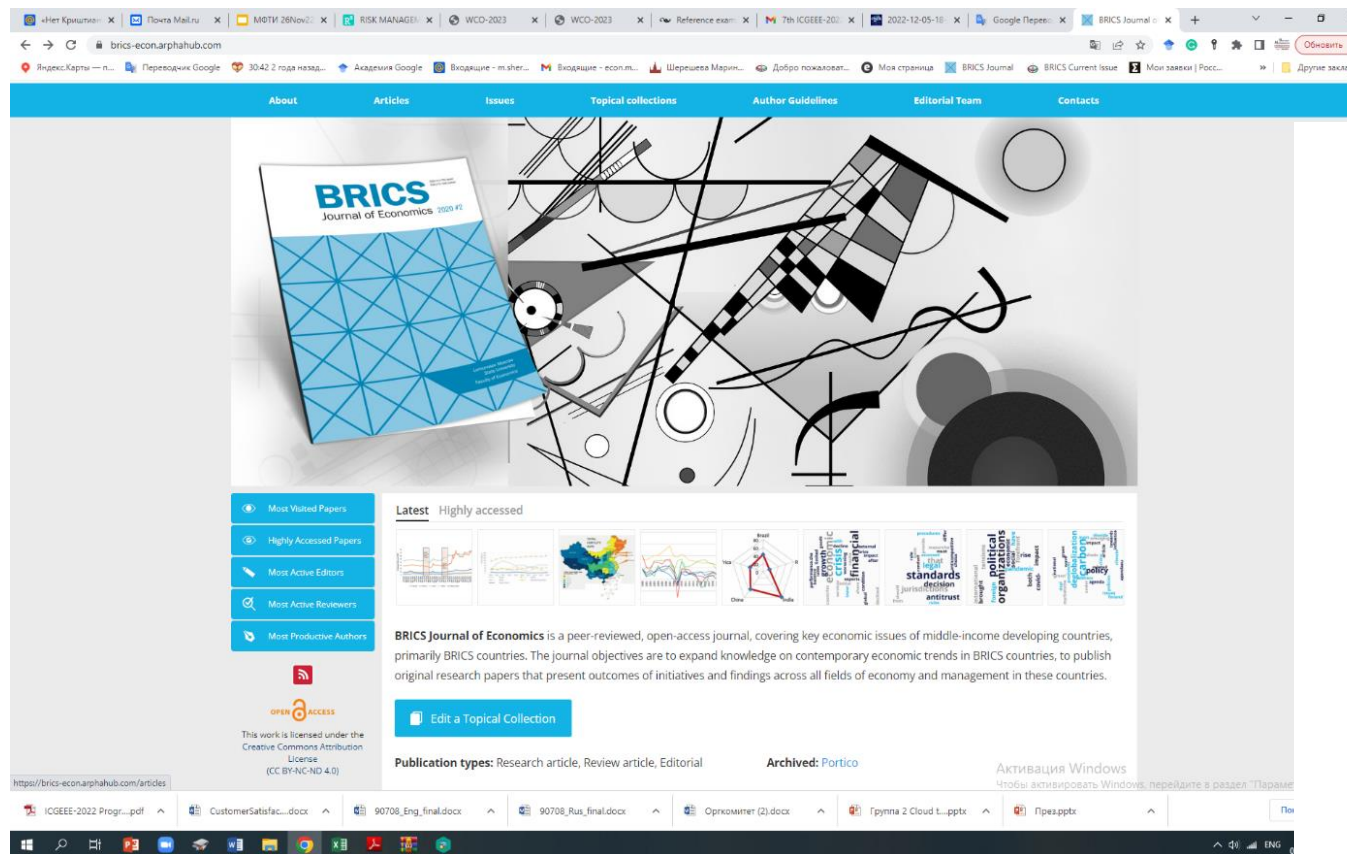**Marina Sheresheva, Anna Polukhina, and Dmitry Napolskikh**

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BRICS Journal of Economics

- A **peer-reviewed, open-access** journal, covering key economic issues of middle-income developing countries, primarily BRICS+ countries

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- **Sustainable Development**
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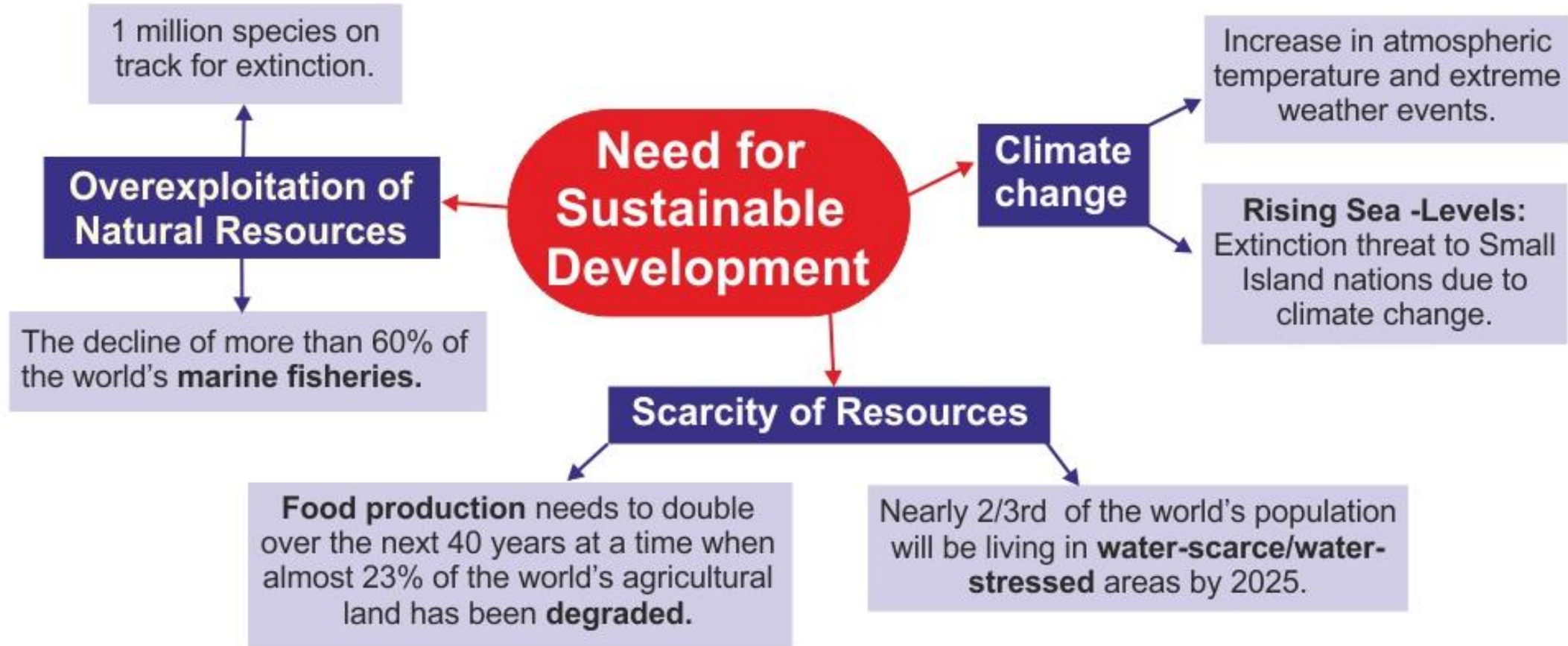- Business Administration

Overview

- **Introduction**

- **Study purpose and RQs**

- **Research methodology**

- **Preliminary results**

- **Concluding remarks**

- **Limitations and future research**

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Introduction

1 million species on track for extinction.

Increase in atmospheric temperature and extreme weather events.

Overexploitation of Natural Resources

Need for Sustainable Development

Climate change

Rising Sea -Levels: Extinction threat to Small Island nations due to climate change.

The decline of more than 60% of the world's **marine fisheries.**

Scarcity of Resources

Food production needs to double over the next 40 years at a time when almost 23% of the world's agricultural land has been **degraded.**

Nearly 2/3rd of the world's population will be living in **water-scarce/water-stressed** areas by 2025.

17 SDGs

«Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs» *(International Institute for Sustainable Development)*

https://www.iisd.org/mission-and-goals/sustainable-development

- Sustainability is an essential part of facing current and future global challenges, not only those related to the environment
- The 17 SDGs, with their 169 targets, form the core of the 2030 Agenda
- They balance the economic, social and ecological dimensions of sustainable development

https://www.drishtiias.com/to-the-points/paper3/sustainable-development-3

THREE PILLARS of sustainability: environmental social economic	→	The problem of coordination and measurement	→	System of sustainable development indicators / integrated indicator?

Introduction

- Increased competition in the high-tech markets, growing challenges of global disintegration, as well as the external threats to national security and integrity of many countries, necessitate a proactive policy to strengthen the technological sovereignty and sustainability

- UN Decade of Action for achieving the SDGs

- In Russia, the need to ensure national economic security and sustainable regional socio-economic development actualizes the need for analysis and theoretical understanding of cluster development processes impact on the innovative development consistency

https://eng.rosstat.gov.ru/sdg/report/document/70355
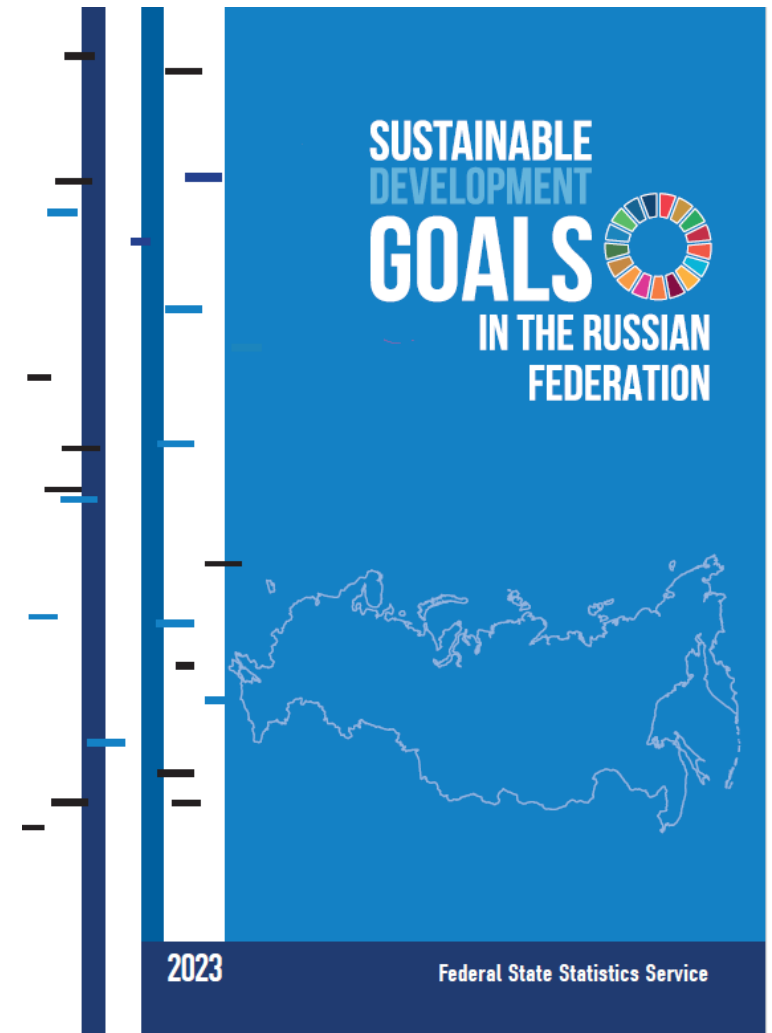
The purpose of the study

- To develop a comprehensive methodological approach to the analysis of the resource potential of regions with developing innovative clusters

- RQ1: *Is there mutual dependence between the consistency of innovative development and the degree of clustering in the regional economic space in Russia?*

- RQ2: *What can be a methodology to analyze the resource potential of innovative clusters in the context of SDGs?*

- RQ3: *Can the creation of new transnational clusters with BRICS countries and the Eurasian Economic Union be particularly relevant for Russian regions?*

Research Methodology

- The proposed methodology includes both indicators for assessing the factors of forming innovative regional economy, and indicators for the effectiveness of regional innovative development

- Index of Resource Potential for Sustainable Development (IRPSD) - 5 sub-indices:

  1. Index of Economic Potential for Sustainable Development (IEPSD)

  2. Index of Human Potential for Sustainable Development (IHPSD)

  3. Index of Financial Potential for Innovative Development (IFPSD)

  4. Index of Scientific and Technological Potential for Sustainable Development (ISTPSD)

  5. Index of Cluster Potential for Sustainable Development (ICPSD)

- The sub-indices in turn are formed from the second-level sub-indices and individual regional innovative development indicators calculated by the Federal State Statistics Service of the Russian Federation (Rosstat)

The indicators and sub-indices of the regional innovative development potential

1- IEPSD
1.1. Economi...
1.1.1. Gross
1.1.2. Coeffi...
1.2. Potenti...
1.2.1. Share
volume of in...
1.2.2. Share
modified inn...
the total vol...

2 - IHPSD
2.1. HR potential
sectors
2.1.1. Share of pe...
total number of p...
2.1.2. Share of pe...
services in the tot...
2.2. Educational
2.2.1. Share of the...
number of econo...
2.2.2. Number of
thousand residen...
2.3. Human resou...
2.3.1. Ratio of the
to the average sa...
2.3.2. Share of en...
annual number of p...
2.3.3. Share of young researchers in the...
researchers in the region
2.3.4. Share of researchers with an acade...
number of researchers in the region

3 - IFPSD
3.1. Budget financ...
3.1.1. Share of civi...
regional budget in...
3.1.2. Share of con...
total expenditures...
3.1.3. Ratio of fede...
innovation infrastr...
3.2. Financing R&L...
3.2.1. Internal R&D...
regional product (%...
3.2.2. Internal R&D...
in the region
3.2.3. Share of con...
internal R&D orgar...
3.2.4. Intensity of t...
industrial enterpris...

4- ISTPSD
4.1. Scientific potential of sustainable regional development
4.1.1. Number of published academic papers per ten researchers in the region
4.1.2. Number of patent applications for inventions per 1 million people of the economically active population in the region
4.1.3. Number of created advanced production technologies per 1 million people of the economically active population in the region
4.1.4. Ratio of financial receipts volume from technology exports to the volume of gross regional product
4.2. Technolo...
4.2.1. Share
innovations
4.2.2. Share
and marketi...
4.2.3. Share
technologicc...
4.2.4. Share
projects
4.2.5. Share
innovations

5 - ICPSD
5.1. Number of clusters with a low level of institutional development (per 1 million people of the economically active population of the region)
5.2. Number of clusters with an average level of institutional development (per 1 million people of the economically active population of the region)
5.3. Number of clusters with a high level of institutional development (per 1 million people of the economically active population of the region)

Research Methodology

- When calculating the regional **Index of Resource Potential for Sustainable Development (IRPSD)**, as well as the sub-indices of both levels, all indicators have equal weighting factors
- At the same time, the initial values of the indicators should be normalized in order to make them usable within the framework of a single methodology
- Accordingly, the IRPSD is calculated using the following formula:

$$\text{IIRPSD}^r = \frac{1}{n}\sum_{i=1}^{n}\frac{x_i^r - x_i^{min}}{x_i^{max} - x_i^{min}}$$

where IRPSD^r – index of innovative development potential of the *r*-th region;

n – the number of regional innovative development potential indicators used to calculate the final index;

x_i^r – the value of the *i*-th indicator of the regional innovative development potential in the *r*-th region;

x_i^{max} – the highest value of the *i*-th innovative development potential indicator in the analyzed sample;

x_i^{min} – the lowest value of the *i*-th innovative development potential indicator in the analyzed sample.

- Analyzing the processes of clustering in the Volga region
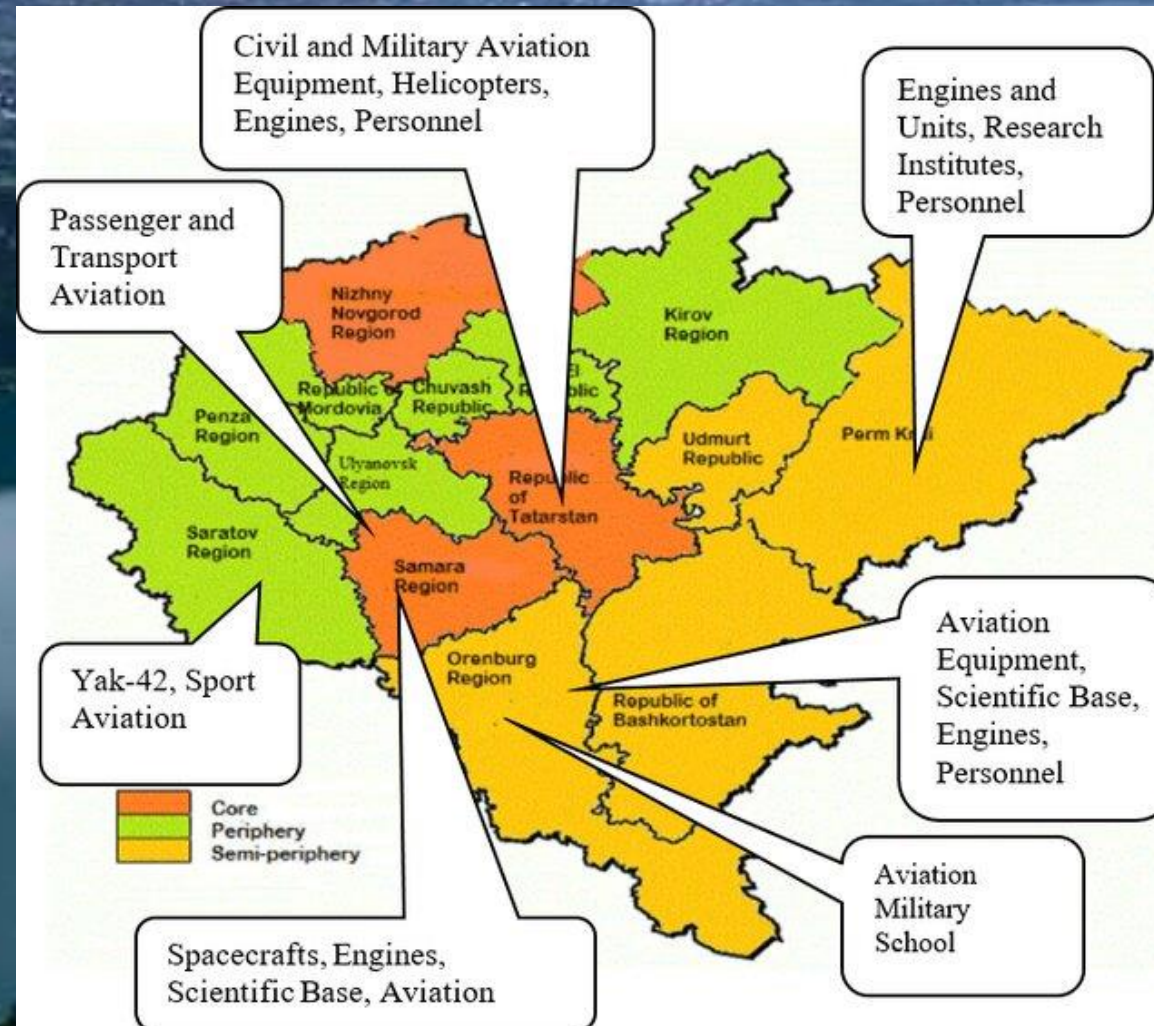
Preliminary results

- In addition to the official statistical data (Rosstat), we used the data of the Russian Regional Innovation Ranking (HSE University)* as an information base for calculating the index

- The grouping of regions was carried out on the basis of the our own model of clustering the economic space

- As a result, we have identified:
  - 2 macroregions (Volga-Kama, and Volga-Urals)
  - 4 districts (Volga-Vyatka, Kama, Middle-Volzhsky, and South-Pre-Urals)
  - 4 interregional clusters (Nizhny Novgorod, Kazan, Samara, and Saratov)

* The ranking comprises a system of 53 indicators for five key sub-indices: Socio-Economic Conditions for Innovation Activities Index, S&T Potential Index, Innovation Activities Index, Export Activities Index and Quality of Innovation Policy Index. Regions are ranked according to each of these sub-indices, and the final index is formed as the average of normalized values of all indicators included in the ranking

Preliminary results:
significant differentiation in the resource potential

Region	The number of clusters operating in the region and corresponding to a certain level of institutional development		
	low level of institutional development	average level of institutional development	high level of institutional development
Republic of Mordovia	1	0	0
Republic of Tatarstan	0	1	0
Republic of Mari El	3	2	1
Chuvash Republic	0	0	0
Kirov Region	1	0	0
Perm Krai	0	0	0
Udmurt Republic	1	2	0
Samara Region	0	0	1
Ulyanovsk Region	1	1	0
Saratov Region	0	0	2
Penza Region	0	0	0
Republic of Bashkortostan	3	1	0
Orenburg Region	0	0	1

Preliminary results: IRPSD values of the Volga regions

- We grouped the Volga regions into macroregions, districts and interregional clusters based on previously conducted studies

- In each group, one can identify a "leading region" and lagging regions

- One can conclude that there is a fairly strong heterogeneity of the regions in terms of the average level and the direction of the index value dynamics

- Only two regions demonstrate a high index value and its positive dynamics over the analyzed period: the *Nizhny Novgorod Region* and the *Republic of Tatarstan*

- Taking into account these conclusions, we then consideedr the economic potential for sustainable development of the Volga regions

Regions	IRPSD
Volga Federal District	**0,356**
VOLGA-KAMA MACROREGION	**0,373**
Volga-Vyatka district	***0,392***
Nizhny Novgorod interregional cluster	0,426
Nizhny Novgorod region	0,480
Republic of Mordovia	0,373
Kasan interregional cluster	0,375
Republic of Tatarstan	0,480
Republic of Mari El	0,332
Chuvash Republic	0,390
Kirov region	0,299
Kama district	***0,315***
Perm Krai	0,346
Udmurt Republic	0,285
VOLGA-URAL MACROREGION	**0,332**
Middle-Volzhsky district	***0,345***
Samara interregional cluster	0,366
Samara region	0,346
Ulyanovsk region	0,386
Saratov interregional cluster	0,324
Saratov region	0,287
Penza region	0,360
South-Ural district	***0,307***
Republic of Bashkortostan	0,366
Orenburg region	0,247

Preliminary results: IEPSD values of the Volga regions

- *Republic of Tatarstan* plays key role in the innovative development of the entire *Volga-Kama region*, as well as in the activation of innovative effects within the framework of the *Kazan interregional cluster*

- *Republic of Tatarstan* is also one of the most active Russian regions in the cluster initiatives implementation

- The *Republic of Mordovia* scores, higher than *Nizhny Novgorod region*, can be explained by the active development of the electrical engineering industry

- The high indicators of the *Republic of Mari El*, small in territory and population, can be explained by the system-forming role of large high-tech enterprises in its economy

Regions	IEPSD
Volga Federal District	0,24
VOLGA-KAMA MACROREGION	0,27
Volga-Vyatka district	*0,28*
Nizhny Novgorod interregional cluster	*0,29*
Nizhny Novgorod region	0,25
Republic of Mordovia	0,32
Kasan interregional cluster	*0,27*
Republic of Tatarstan	0,41
Republic of Mari El	0,30
Chuvash Republic	0,22
Kirov region	0,16
Kama district	*0,25*
Perm Krai	0,28
Udmurt Republic	0,22
VOLGA-URAL MACROREGION	**0,21**
Middle-Volzhsky district	*0,22*
Samara interregional cluster	*0,27*
Samara region	0,31
Ulyanovsk region	0,23
Saratov interregional cluster	*0,17*
Saratov region	0,13
Penza region	0,21
South-Ural district	*0,18*
Republic of Bashkortostan	0,19
Orenburg region	0,16

Preliminary results: human resources of the Volga regions

- One can note the high values of the sub-index "Human Resource Potential of Regional Science" for all Volga regions, with the leadership of the *Nizhny Novgorod region*, the *Samara region*, and the *Ulyanovsk region*, with two cities of *Ulyanovsk* and *Dimitrovgrad* as scientific and educational centers

Regions	IHPSD
Volga Federal District	**0,44**
VOLGA-KAMA MACROREGION	**0,44**
Volga-Vyatka district	**0,46**
Nizhny Novgorod interregional cluster	0,48
Nizhny Novgorod region	0,53
Republic of Mordovia	0,42
Kasan interregional cluster	0,45
Republic of Tatarstan	0,49
Republic of Mari El	0,47
Chuvash Republic	0,47
Kirov region	0,39
Kama district	0,38
Perm Krai	0,41
Udmurt Republic	0,35
VOLGA-URAL MACROREGION	**0,43**
Middle-Volzhsky district	**0,46**
Samara interregional cluster	*0,50*
Samara region	0,50
Ulyanovsk region	0,50
Saratov interregional cluster	0,42
Saratov region	0,43
Penza region	0,41
South-Ural district	*0,37*
Republic of Bashkortostan	0,43
Orenburg region	0,32

Preliminary results: ISTPSD values of the Volga regions

- *Republic of Tatarstan* is leading in scientific and technical potential for sustainable development of the Volga region

- Overall, it is the key region for innovative transformation that possess two centers of transformation: the *Kazan city* and the *Nizhne-Kama agglomeration*

- The *Kazan city* is considered as a potential point of boosting innovative activity growth and cluster initiatives in the *Chuvash Republic* and *Mari El Republic*, the *Nizhne-Kama agglomeration* can play this role for the Vyatka-Kama zone (*Kama District* and *Kirov Region*)

Regions	ISTPSD
Volga Federal District	0,38
VOLGA-KAMA MACROREGION	0,42
Volga-Vyatka district	0,45
Nizhny Novgorod interregional cluster	0,47
Nizhny Novgorod region	0,50
Republic of Mordovia	0,44
Kasan interregional cluster	0,43
Republic of Tatarstan	0,61
Republic of Mari El	0,32
Chuvash Republic	0,51
Kirov region	0,30
Kama district	0,35
Perm Krai	0,35
Udmurt Republic	0,34
VOLGA-URAL MACROREGION	0,32
Middle-Volzhsky district	0,33
Samara interregional cluster	0,29
Samara region	0,29
Ulyanovsk region	0,29
Saratov interregional cluster	0,36
Saratov region	0,29
Penza region	0,43
South-Ural district	0,30
Republic of Bashkortostan	0,34
Orenburg region	0,25

Concluding remarks

- The obtained results allowed us to assess the Volga regions sustainable development based on the proposed multi-level model and to confirm:

  - *growing economic potential for sustainable development in these regions*

  - *positive impact of cluster development programs and complementary projects on the dynamics of the Volga regions resource potential*

- The dynamics of indicators characterizing the financial potential of innovative development shows that regions with active cluster policies attract innovation financing more effectively

- Uneven distribution of clusters by regions, as well as differences in the level of resource potential are explained by both objective economic and geographical prerequisites and the effectiveness of regional authorities activity within the framework of federal cluster development programs

Concluding remarks and future research

- Though the results helped to trace the relationship between innovative potential, innovative and cluster activity, the key limitation for drawing conclusions about the cluster policy impact on the innovative transformation of the Volga regions' economy is that competitive industries in large economic, scientific, and educational centers were subjects to clustering at the first stage

- Additional research is needed to confirm that the resource potential of Russian clusters acquires additional growth opportunities due to inclusion in key parts of changing global production chains in the context of BRICS and the Eurasian Economic Union partnerships

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