ASSESSMENT OF THE INNOVATION POTENTIAL OF THE SELECTED REGIONS[*]

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Abstract. Assessment of innovation potential is becoming an increasingly urgent problem. Many scientists and researchers are interested in this issue, alas, evaluate innovation potential differently. Some scholars emphasize resources, while others think about the achieved result. Another group of researchers focus on the transition process from resources to results while evaluating innovation potential. This paper attempts to integrate the three basic approaches (resource, process and resulting) and suggest a combination of known innovation potential assessment methods. The author claims that the innovation development goal is the result (abilities) and initial resources (opportunities) and stresses a process of transformation into an innovative product. The author offers an original definition of the innovation potential of a region. Complex evaluation with the sum method leads to an original integral indicator. Selected geographical areas are grouped into quintiles; the obtained results are depicted on maps for more convenient perception and visualization. The obtained results are interpreted, and policy implications are suggested.

Keywords: innovation; innovation potential; innovation potential evaluation methods; Latvia; Lithuania; other neighbouring countries

1. Introduction

The competitiveness of regional goods and services is vital for the economic development of any region. Regional production can play an essential role in this aspect. Innovations are one of the main factors in the region's growth.

Assessing the region's innovation potential is crucial for substantiating the regional innovation policy and developing regional development programs facilitating the effective use of regional innovation resources.

The purpose of the presented research is to develop a methodology for assessing the innovation potential of regions. Latvia, Lithuania and Belarus are selected as geographical areas, which are evaluated and compared.

Here it has to be noted that Belarus, as the geographical area for the research, was selected before dramatic events took part in the state. In addition, it has to be stated that in the given study, the innovation potential of the selected regions is not a key issue. Still, it is essential to reveal differences in results when different methods are used.

The following tasks have been set to achieve the goal:
- to analyze the theoretical and methodological foundations of regions' innovation potential;
- to determine the indicators of the innovation potential from the point of view of the resource approach;
- to determine the indicators of the innovation potential from the point of view of the process approach;
- to determine the indicators of the innovation potential from the point of view of the result approach;
- to compare the results of different basic approaches and to propose a method for evaluating the innovation potential in different regions.

Methods of the research: logical analysis and synthesis; monographic, analytical, logical-constructive methods of researching international economic theoretical and empirical sources; method of the sum of the coefficients of determination of the largest dependent variable using the explanatory variable; method of linear scaling principle; frequency analysis; correlation analysis; sum method analysis; quintile grouping method; cartographic method and other methods of statistical analysis.

The scientific novelty of the research:

- epistemological aspect – new data on the innovation potential of regions and the essential interrelationships of resources have been obtained in the research process;
- methodological aspect – the methodology for determining the innovation potential of regions developed and approved by the author;
- the author clarifies the content of the concept of innovation potential and adapts it to the regional context within the given research, emphasizing the connection with initial resources.

The practical value of the research:
- the research can be used in practice at various levels of state structures to develop policies that would stimulate the implementation and development of innovations in specific regions;
- the author determines the level of innovation potential development, which is an essential prerequisite for the development of an investment policy;
- the author identifies regions with a labour shortage, which creates additional opportunities for the implementation of interregional development policy, and the need for universities to improve training programs for qualified employees in the field of innovation.

The author does not analyze most of GII (Global Competitiveness Index) indicators, which is since many of these indicators are not collected in official statistics in the regions of the given research, some of them are not available at all or are only available at the national level or are available in several regions. Thus, the author uses selected (Schumpeter, 1939; Schlesinger Jr., 1986; Freeman, 1995; Farrow, 2021; Carlström, 2022; Erdin & Caglar, 2022; Franco et al., 2022.; Jaiswal et al., 2022; Liu & Shao, 2022) and available indicators, which will be used for evaluation of innovation potential of the regions of selected countries.

2. Theoretical and methodological framework of innovation potential

The concept of innovation is quite complex. Schumpeter (1939); Mensch (1979); Whitfield (1979); Twiss (1989); Fukuda and Watanabe (2012); Lukjanska (2014); Freeman (2017); Hudakova, Fila and Marosh (2018); Waldron and Wetherbe (2020); Liu and Shao (2022); Maâlej (2022), Mikelsone, Spilbergs, Volkova and Liela (2022); Nikina-Ruohonen (2022); Repeshko (2022); Sawalkar, Shinde, Mali, Parlikar and Mortale (2022) and many other scientists also studied a wide range of phenomena impacted by various types innovations.

Scientists (e.g. Schumpeter, 1939; Schlesinger Jr., 1986; Twiss, 1989; Sangadiyev et al., 2006; Lunarski et al., 2007; Drucker, 2009; Freeman, 2017; Hudakova et al., 2018; Langham et al., 2020; Waldron et al., 2020; Farrow, 2021; Shvets et al., 2021; Andriushchenko et al., 2022; Franco et al., 2022; Heilala, 2022; Liu et al., 2022; Maâlej, 2022; Mikelsone et al., 2022; Nikita-Ruohonen, 2022; Repeshko, 2022; Sawalkar et al., 2022; Sheffield et al., 2022; Shvindina et al., 2022; Sinclair-Desgagne, 2022; White, 2022) analyze innovation though different lenses. They look at this broad phenomenon via changes, resources, processes and results.

The concept of innovation potential follows from the definition of innovation.

Poznanska (1998) asserts that innovation potential is the ability to implement innovations effectively, i.e., to introduce new products, technologies, organizational methods and marketing innovations. Innovation potential understood in this way depends on four main elements: financial potential, human potential, material potential, and knowledge.

Nikolayev (2001) believes it is a system of factors and conditions necessary to implement the innovation process.

Zhits (2007) understands innovation potential as available economic resources that society can use to develop at a given moment. He mentions scientific-technical, educational potential and investment potential. The set of these factors, according to Zhits, constitutes the innovation potential of the macro system.

Davies, Gann and Douglas (2009) argue that the innovation potential can be enhanced via collaborations between different structures.

Hudakova, Fila and Marosh (2018) consider the innovation potential of regions as the primary source of their competitiveness in achieving their economic, social and environmental goals.

The GII (Global Innovation Index) 2021 model includes 81 indicators, which fall into three categories: quantitative data (63 indicators), index data (15 indicators) and qualitative data (3 indicators), including indicators relating to the political situation, education system, infrastructure and knowledge creation in each country.

Maâlej (2022); Chehabeddine, Grabowska and Adekola (2022) point out that innovation is essential in the environmental dimensions of economic growth.

Shvindina, Taraniuk, Kotenko, Abayomi, Taraniuk and Qiu (2022) understand the innovation potential as a difference between the system's current state in terms of innovation performance and its potential outcomes based on existing innovative capabilities.

Most of the current research in this area is mainly general and theoretical or is devoted to solving innovation management issues. The growing role of innovation potential has created the need for a scientific understanding of problems related to research, development, management of innovation processes, stimulation of innovation activity and commercialization of innovations. In the 1950s-1960s, the problems of scientific and technological development aspects were evaluated mainly at the macro level, with the definition of the concept in the context of a broad approach as measures that promote or hinder countries' economic growth. Since the 1970s, scientists' interest in innovation development problems gradually moved from macroeconomic to microeconomic tasks. Since the 90s of the XX century, scientists have evaluated the development of innovation potential at the meso-level, considering it a combination of different types of resources, which is a relatively narrow definition of this

economic category. Still, some scientists associate this concept with the result of innovation activity, which also narrows the explanations to the innovation process for the resulting product. The author believes that scientists do not pay enough attention to the abilities and opportunities for the implementation of innovation activity in the definition of innovation potential at the meso-level, because this interpretation indicates the type of innovation development, the goal of which is the result (abilities) and the initial resources (opportunities), and the existence of a connection should also be emphasized with the transformation of resources into an innovative product.

Thus, the innovation potential of the region is the readiness of the region for innovation, which is manifested as the opportunity and ability of the region to transform the initial resources available to the region into a competitive and market-demanded innovation - a new product or service.

3. Evaluation methodology of the innovation potential

The structure of innovation potential is different for various levels of the economy. When determining the innovation potential of the region, the level of innovation development of the regional economy should be assessed, as well as the opportunities of innovation development of existing organizations in the specific territory. Assessment of the region's innovation potential must be related to different components (see Figure 1).
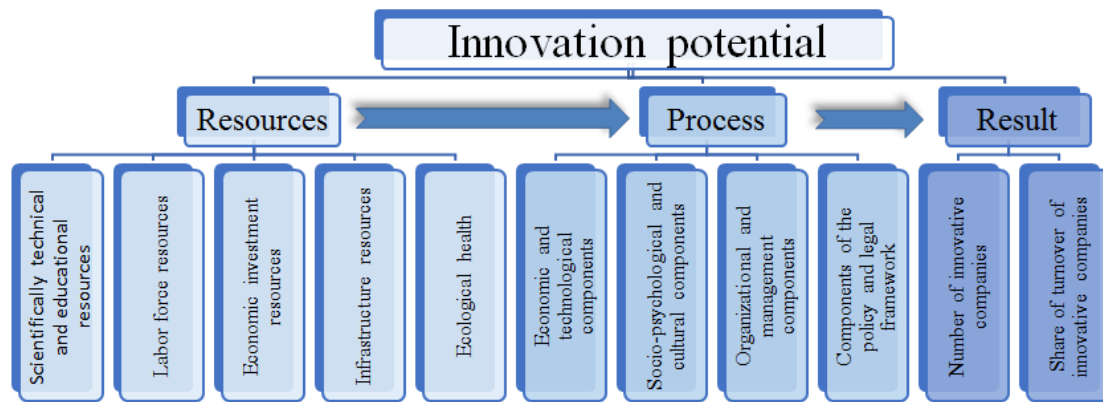

Figure 1. Structure of the innovation potential in the innovation system

Source: made by author using critical review of literature provided above

The author examines the region's innovation potential according to the following components (Santo, 1990; Matveykin et al., 2007; Drucker, 2009; Agarwal et al., 2022; Birkner et al., 2022; Bychin, 2022; Carlström, 2022; Erdin & Caglar, 2022):

- The resource component:
  - scientifically technical and educational resources, which include the number of scientific research centres and the number of people employed in them, the number of students in secondary schools of general education, the number of students enrolled in vocational schools and universities, the number of public education schools, number of libraries, distribution of companies by main types of activity, etc. indicators in relative units of measurement;
  - labour force resources, which include population density, population up to working age, at the working age, above the working age, natural increase, migration rate, level of demographic burden, economic activity, birth rate, mortality rate, employment rate, unemployment, etc. indicators in relative units;

- o financial investment resources, which include GDP, inflation, average wages, value-added indicators by types of activity, distribution of companies by main types of activity, accumulated direct foreign investments, non-financial assets, number of companies, number of people employed in agriculture, purposes of citizens' use of the Internet, etc. indicators in relative units;
  - o infrastructure resources, which include the relative indicators of the region's territorial area, share of cities in the total number of cities, counties or districts of the country, percentage of counties or districts in the total number of cities, counties or districts in the country, distribution of the territory by land type, road density, agricultural land, forestry, swamps and land of water bodies, computer and Internet availability, purposes of Internet use, provision of passenger cars, etc. indicators in relative units;
  - o ecological health, which includes indicators of emissions of harmful substances into the atmosphere (kg per capita), relative indicators of the chemical composition of harmful substances;
- process component:
  - o Economic and technological components;
  - o Socio-psychological and cultural components;
  - o Organizational and management components;
  - o Components of the policy and legal framework;
- result component:
  - o number of innovative companies;
  - o share of turnover of innovative companies.

The innovation management style depends on the level of technological and economic development of the economy and the innovation potential of the territory.

Summarising the above, the main principles of the innovation potential development are determined:

- the development of science and technology at the current stage cannot be isolated from each other;
- innovation and technological development lead to profound structural changes in the economic, social and political fields;
- for the effective implementation and development of science and technology, appropriate economic conditions and institutions must be created;
- the development of innovations can have not only positive but also negative consequences;
- economic downturn creates a new wave of innovation development;
- the development of innovation and technologies is cyclic;
- based on the analogy with natural systems, economic development can be viewed through the prism of innovation ecosystems, the distinguishing feature of which is the ability of internal dynamics and development under the influence of both endogenous and external factors;
- innovation potential can be defined as a combination of different resources: science, education, labour, economy, investment, infrastructure, and ecological.

The given classification of approaches is also still being determined. These approaches can be created entirely differently if other criteria are accepted and used, for example, directly using strategies to define the concept of innovation potential.

Regional innovation development must meet at least two requirements:

- transfer national-level powers to the regional level,
- promote the development of the state, society and private organizations in the specific region.

The innovation potential at the regional level is a strategic factor in the market, which is part of the overall business development strategy aimed at gaining or maintaining the leading position in the sector. With the development of innovation potential, it is possible to create competitive products to ensure long-term growth.

Creating an integral indicator by the selected indicators

The method of creating the integral indicator consists of several stages:
- unification of statistical data according to the principle of linear scaling, determining the value range in the row interval [0; 10] according to the following formulas: (Ayvazyan, 2005):

  - indicators-stimulants: $x'_{ij} = \dfrac{x_{ij} - x_{min\,j}}{x_{max\,j} - x_{min\,j}} * 10$ \hfill (1)

  - indicators-destimulants: $x'_{ij} = \dfrac{x_{max\,j} - x_{ij}}{x_{max\,j} - x_{min\,j}} * 10$ \hfill (2)

where x'_{ij} – "j" the unified notation for the region "i",

x_{min} – the lowest (worst) value of the output indicator in the study period,

x_{max} – the output indicator's highest (best) value in the study period.

- dimension reduction for the selection of the innovation potential diagnostic indicators from the wide range of available statistical indicators, which can replace all previous indicators without reducing the objectivity of the results and exclude indicators with duplicate or similar meanings:
  - correlation coefficient (r(Pearson)) calculation for statistical indicators by the formula: \hfill (3)

$$r(Pearson) = \frac{\sum_{i=1}^{n}(x_i - \bar{x}) \cdot (y_i - \bar{y})}{(n-1) \cdot S_x \cdot S_y} = \frac{cov(x, y)}{\sqrt{S_x^2 S_y^2}},$$

  - calculation of coefficients of determination for statistical indicators, where the significance of correlation coefficients is within the range [0,01;0,05] by the formula: $R^2 = r^2$, \hfill (4)
  - calculation of the sum of the obtained coefficients of determination for each statistical indicator:

$$y_i = \sum_{j=1}^{m} R^2_{ij} ,$$ \hfill (5)

  - selection of statistical indicators according to the obtained sums of determination coefficients using the logical and largest sum principle.

- creation of the integral indicator based on the selected indicators:
  - aggregation of indicators of factors determining innovation potential:

$$y_{ij} = \sum_{j=1}^{m} x_{ij} ,$$ \hfill (6)

- o unification of the values of the obtained innovation potential factors, determining the value in the row interval [0;10] by the formula 1,
- o aggregation of the obtained unified values of innovation potential factors in creating an integral indicator of the region's innovation potential:

$$y_i = \sum_{j=1}^{m} x_{ij} \, , \tag{7}$$

- o unification of the obtained innovation potential values determining the value range within the interval [0;10] by the formula 1.

4. Empirical data and analysis

The following regions are included in the study:

Latvia - 6 statistical regions (Order of the Cabinet of Ministers No. 911 of 07.12.2021 "About the statistical regions of the Republic of Latvia and the administrative units included in them" 2021): Riga region, Pieriga region, Vidzeme region, Kurzeme region, Zemgale region, Latgale region.

Lithuania - 10 counties (Law of Republic of Lithuania No I-558 "Law on the Territorial Administrative Units and their Boundaries" 1994): Vilnius county, Alytus county, Kaunas county, Klaipeda county, Marijampole county, Panevežys county, Siauliai county, Taurage county, Telšiai county, Utena county.

Belarus (Law of Republic of Belarus 154-3 "On the administrative and territorial division and the procedure for solving the issues of the administrative and territorial organization of the Republic of Belarus" 1998): 6 oblasts: Brest oblast, Vitebsk oblast, Gomel oblast, Grodno oblast, Minsk oblast, Mogilev oblast, Minsk (capital).

The studied regions are border areas of the EU and the CIS: Latvia and Lithuania are EU members, and Belarus is a CIS member.

Evaluation of the resource component of the innovation potential of the selected regions

The author unifies statistical indicators by applying the linear scaling principle, dividing the indicators into indicators-stimulants and indicators-destimulants. As a result, the range of indicator values is determined within the interval [0;10].

The author performs dimension reduction for optimization of statistical indicators using the method of the sum of the coefficients of determination of the most significant dependent variable by the explanatory variable and evaluates the innovation potential according to the following indicators:

- scientifically technical and educational resources:
  - o the number of scientific research centres per 100,000 inhabitants,
  - o the number of people employed in scientific research centres per 100,000 inhabitants,
  - o the number of students enrolled in vocational colleges per 10,000 inhabitants,
  - o the number of students enrolled in higher education institutions per 10,000 inhabitants,
  - o number of general education schools per 10,000 inhabitants,
  - o number of library visitors per 100,000 inhabitants,
  - o distribution of companies by main types of activity in Latvia, Lithuania, Belarus and their regions, % - scientific and technical services;
- labour force resources:
  - o population density (people/sq.km),
  - o population up to working age, %,
  - o population at the working age, %,
  - o the level of the demographic burden - in total,
  - o employment level, %,

- o unemployment level, %,
  - o economic activity, %;
- economic investment resources:
  - o GDP per 1 inhabitant, euro,
  - o distribution of companies by main types of activity in selected countries and their regions, % - production,
  - o distribution of companies by main types of activity in selected countries and their regions, % - power industry,
  - o distribution of companies by main types of activity in selected countries and their regions, % - information and communication,
  - o distribution of companies by main types of activity in selected countries and their regions, % - education, healthcare, social work,
  - o the amount of accumulated foreign direct investment in the region relative to the total amount in the country, %,
  - o non-financial assets, in actual prices, in the region relative to the total volume of the country, %,
  - o inflation,
  - o average salary (gross), euro,
  - o total number of enterprises (micro (small), small, medium, large) per 1000 inhabitants,
  - o purposes of inhabitants' internet use – for internet banking, %,
  - o purposes of inhabitants' internet use – for goods sale, %;
- infrastructure resources:
  - o the proportion of cities in the total number of cities of the country, %,
  - o the proportion of counties or districts in the total number of cities of the country, %,
  - o the ratio of the area of the region in the whole area of the three countries, %,
  - o agricultural land, %,
  - o land of other types, %,
  - o road density per 1000 km^2 of the territory,
  - o Internet availability in various households, %,
  - o provision of passenger cars per 1000 inhabitants,
  - o purposes of inhabitants' internet use – for information search, %,
  - o purposes of inhabitants' internet use – receiving/sending e-mails, %,
  - o purposes of inhabitants' internet use – for communication with the state, %;
- ecological health:
  - o emissions of harmful substances into the atmosphere (kg per inhabitant),
  - o emissions of harmful substances into the atmosphere, kg per inhabitant - solid particles,
  - o emissions of harmful substances into the atmosphere, kg per inhabitant – carbon monoxide,
  - o emissions of harmful substances into the atmosphere, kg per inhabitant - other substances.

The author evaluates each resource included in the innovation potential with the help of an integral indicator, summing up the indicators of each resource and determining the value in the row interval [0;10].

The author evaluates the innovation potential of regions with the help of an integral indicator, summing up the resources included in the innovation potential and determining the range of the indicator's value in the interval [0;10].
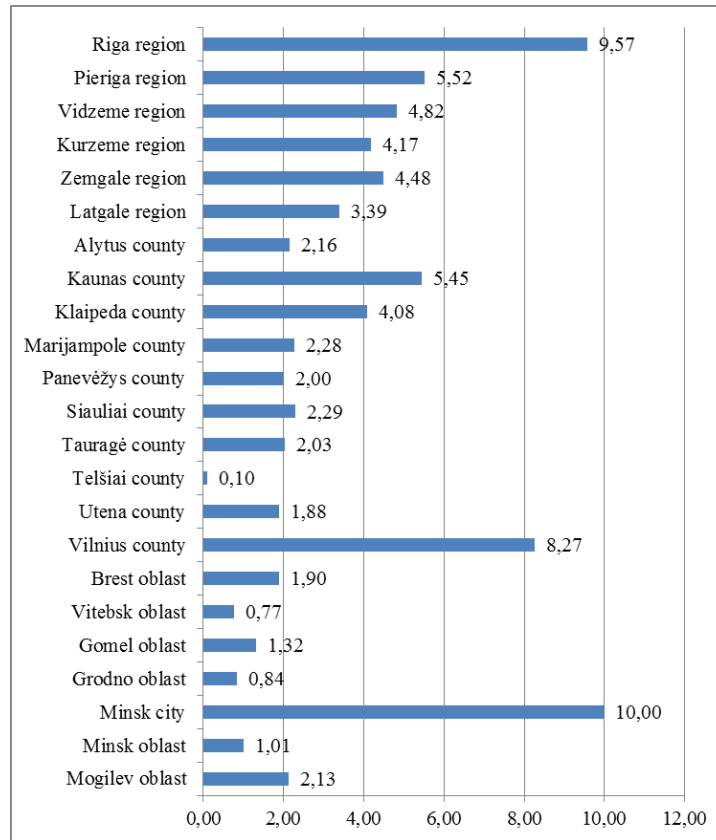
Figure 2. Evaluation of the resource component of the innovation potential of Latvia, Lithuania and Belarus regions.
Source: created by the author based on the data of the regions of Latvia, Lithuania, and Belarus, using the developed innovation potential evaluation methodology

According to the obtained results, the author classifies the regions of Latvia, Lithuania and Belarus, dividing the value series into quintiles (see Figure 3). The first quintile group includes areas with meagre innovation potential, while the fifth has very high innovation potential.
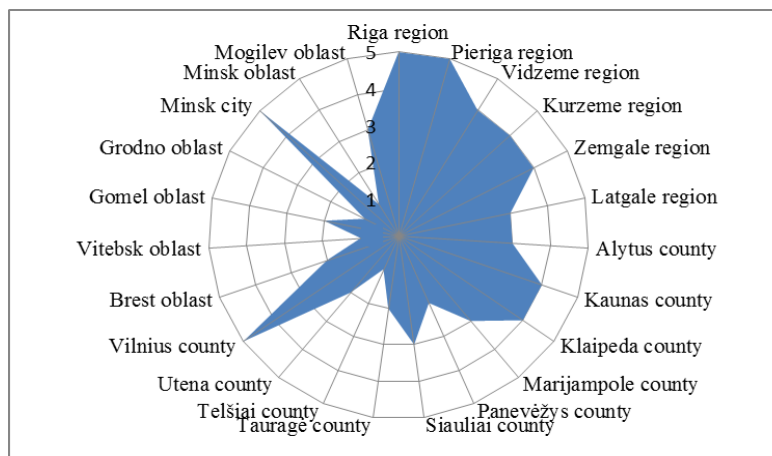

Figure 3. Map of the quintile groups of the innovation potential resource component of the regions of Latvia, Lithuania and Belarus
Source: created by the author based on the data of the regions of Latvia, Lithuania, and Belarus, using the developed innovation potential assessment methodology

The map of quintile groups shows that the regions of Latvia have a relatively high level of innovation potential, the regions of Lithuania have a lower level of innovation potential, and the regions of Belarus have a deficient level of innovation potential. A very high innovation potential has been found in the capital cities. Still, in the other areas – there is a much lower level of innovation potential, which, according to the author, is related to the flow of resources towards the capital cities. The China-Belarus Innovation Commercialization Center largely determines the development of the innovation potential of Minsk; in Riga - by the Innovation and Technology Transfer Center of Riga Technical University (RTU), and in Vilnius - by the laser research and production company *"Šviesos konversija*".

The most significant quantitative and structural differences between capital cities and other regions' innovation potential can be observed in Belarus. Minsk has the highest rating for innovation potential, while the other regions have low values.

Assessment of the process component of the innovation potential of the Latvian, Lithuanian and Belarusian regions

The author surveys experts to assess the process component of the innovation potential of Latvia, Lithuania and Belarus regions.

The circle of experts consists of 30 persons, among whom are the following specialists:

- 10 state and local government administration employees,
- 10 employees of scientific institutions (researchers, lecturers, professors, etc.),
- 10 business representatives.

The author divides the expert survey into four blocks. The author in each block identifies the factors that promote and hinder the development of innovation potential.

The first block is dedicated to economic and technological components:

- existence of a financial reserve,
- presence of a reserve of material and technical means,
- modern technologies,
- the existence of the necessary economic infrastructure,
- the required scientific and technological infrastructure,
- cooperation between different bodies,
- lack of funds to finance innovation projects,
- insufficiency of the material base,
- insufficient scientific and technical base,
- lack of spare capacity,
- the dominance of current production interests.

The second block reflects the socio-psychological and cultural components:

- moral remuneration of participants in the innovation process,
- public recognition,
- possibility of self-realization,
- opportunity for creative work,
- acceptable psychological climate in the work team,
- resistance to changes that may lead to changes in the status of employees,
- resisting change that may necessitate finding a new job,
- resistance to changes that may lead to the restructuring of new jobs,
- resistance to changes that may lead to the reorganization of certain activities,
- resistance to changes that can lead to breaches of behavioural stereotypes and established traditions,
- fear of uncertainty,
- fear of penalties for failure.

The third block consists of organizational and management components:

- the flexibility of the organizational structure,
- democratic leadership style,
- the predominance of horizontal information flows,

- self-planning,
- allowing adjustments,
- decentralization,
- autonomy,
- formation of target work groups,
- the existence of a motivation policy for the creation of clusters,
- a constant organizational structure of the company,
- excessive centralisation,
- authoritarian leadership style,
- the predominance of vertical information flows,
- secrecy of public authorities,
- difficulties in cross-sectoral and inter-organizational interactions,
- the rigour of planning,
- focusing on existing markets,
- emphasis on short-term repayment,
- difficulties in reconciling the interests of innovation actors,
- cluster formation - lack of motivation to create clusters.

The fourth block consists of the components of the policy and legal framework:

- legislative measures (especially incentives) that encourage innovation,
- state support of innovation,
- policy to support transnational economic cooperation,
- antitrust restrictions,
- tax law restrictions,
- restrictions on depreciation legislation,
- restrictions on licensing patent law,
- political barriers to international economic cooperation.

The author offers the respondents to evaluate the factors of each block in the interval from 1 to 5, where:

- 1 – completely uncharacteristic,
- 2 – uncharacteristic,
- 3 – semi-characteristic,
- 4 – characteristic,
- 5 – entirely characteristic.

The author assesses the process component of the innovation potential of the regions using an integral indicator, defining a range of indicator values in the interval [0;10] and dividing the series of values of the process component of the innovation potential into quintiles for comparison and analysis.

Table 1. Standardized values and quintile groups of the innovation potential process component of the regions of Latvia, Lithuania, and Belarus

Region	Normalized values	Quintile groups
Riga region	8,87	4
Pierina region	7,37	4
Vidzeme region	1,58	2
Kurzeme region	2,95	4
Zemgale region	1,11	1
Latgale region	0,57	1
Alytus county	2,40	4
Kaunas county	5,31	4
Klaipeda county	8,29	4
Marijampole county	2,18	3
Panevežys county	1,91	3
Siauliai county	3,28	4
Taurage county	2,28	3
Telšiai county	2,09	3
Utena county	1,82	2

Vilnius county	8,18	4
Brest oblast	0,75	1
Vitebsk oblast	2,33	3
Gomel oblast	1,29	2
Grodno oblast	1,36	2
Minsk city	10,00	5
Minsk oblast	0,10	1
Mogilev oblast	1,17	2

Source: author's calculations based on the statistical indicators of the regions of Latvia, Lithuania and Belarus, using the developed innovation potential assessment methodology

The author presents the obtained results in a diagram to provide a more convenient and straightforward analysis.
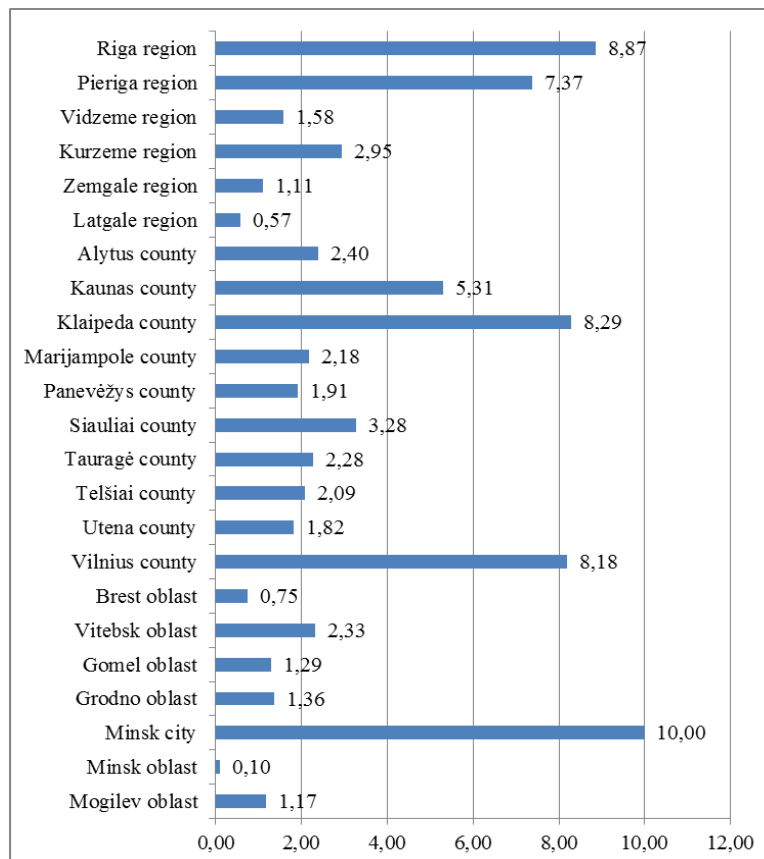

Figure 4. Evaluation of the process component of the innovation potential in the regions of Latvia, Lithuania and Belarus
Source: made by the author based on the data of the regions of Latvia, Lithuania and Belarus, using the innovation potential assessment methodology developed by the author

The highest value of the process component of the innovation potential is obtained by Minsk (10,00 normalized values), Riga region (8,87 normalized values), Klaipeda county (8,29 normalized values), Vilnius county (8,18 normalized values), Pieriga region (7,37 normalized values). The lowest value of the process component of the innovation potential is obtained by Minsk oblast (0,10 normalized values), Latgale region (0,57 normalized values), Brest oblast (0,75 normalized values), Zemgale region (1,11 normalized values), Mogilev oblast (1,17 normalized values), Gomel oblast (1,29 normalized values), Grodno oblast (1,36 normalized values).

For a more detailed analysis of the obtained results, the author creates a quintile groups map of Latvia, Lithuania and Belarus regions.
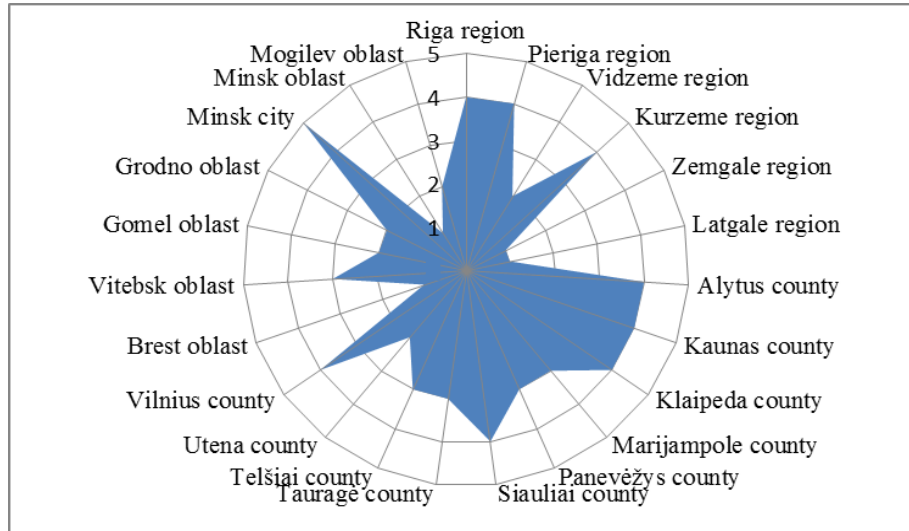

Figure 5. Map of quintile groups of innovation potential process components of Latvian, Lithuanian, and Belarusian regions
Source: developed by the author, based on the data of the regions of Latvia, Lithuania and Belarus, using the suggested methodology

The first quintile group includes Zemgale region, Latgale region, Brest region and Minsk region. The second quintile includes Vidzeme region, Utena county, Gomel oblast, Grodno oblast, Mogilev oblast. The third quintile includes Marijampole county, Panevėžys county, Tauragė county, Telšiai county, Vitebsk oblast. The fourth quintile includes Riga region, Pieriga region, Kurzeme region, Alytus county, Kaunas county, Klaipeda county, Siauliai county, and Vilnius county. The fifth quintile includes Minsk.

According to the values of the integral indicator of the process component of the innovation potential, the highest rating is obtained in Minsk (5th quintile). This is mainly because of the Belorussian China Innovation Center in Belarus, Minsk, which was established in 2010 as a part of the National Innovation Development Program of the Republic of Belarus. Innovation potential as transfer of resources into results is also well managed in the Riga region, Pieriga region, Kurzeme region (Republic of Latvia), Alytus county, Kaunas county, Klaipeda county, Siauliai county, Vilnius county (Republic of Lithuania). Several innovation development centres operate in these regions. There is a high level of development of the process component of innovation potential in capital cities and large urban areas, which the one-way influence of various factors can explain.

Assessment of the result component of the innovation potential of the Latvian, Lithuanian and Belarusian regions

The author evaluates the innovation potential result component with the help of an integral indicator, determining its values in the interval [0;10] and dividing the series of values into quintiles.

Table 2. Standardized values and quintile groups of the innovation potential result component of the regions of Latvia, Lithuania, and Belarus

Region	Normalized values	Quintile groups
Riga region	5,66	3
Pierina region	4,68	3
Vidzeme region	5,61	3
Kurzeme region	3,95	2
Zemgale region	5,41	3
Latgale region	2,58	2
Alytus county	7,52	4
Kaunas county	9,70	5
Klaipeda county	8,40	4
Marijampole county	6,99	4
Panevežys county	6,61	3
Siauliai county	7,55	4
Taurage county	10,00	5
Telšiai county	8,63	4
Utena county	9,26	5
Vilnius county	9,63	5
Brest oblast	1,32	1
Vitebsk oblast	2,72	2
Gomel oblast	1,74	2
Grodno oblast	0,63	1
Minsk city	2,40	2
Minsk oblast	0,34	1
Mogilev oblast	0,10	1

Source: created by the author based on the data of the regions of Latvia, Lithuania, and Belarus, using the innovation potential assessment methodology developed by the author

The highest value of the innovation potential result component is obtained by Tauragė county (fifth quintile group) and the lowest by Mogilev oblast (first quintile group).
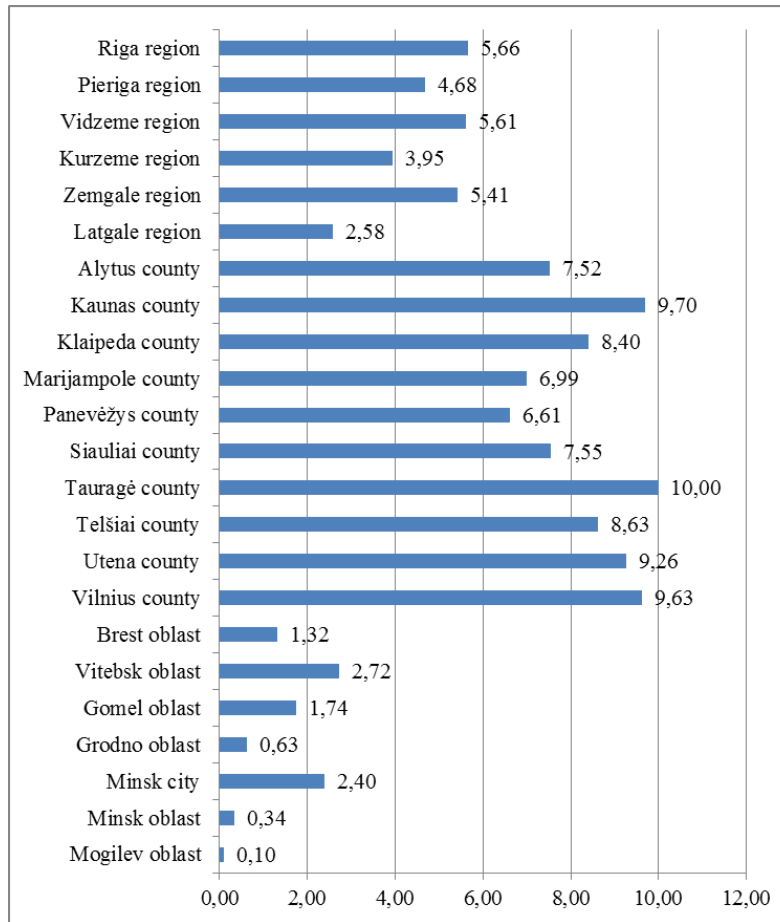
Figure 6. Assessment of the innovation potential result component of the regions of Latvia, Lithuania and Belarus
Source: created by the author based on the data of the regions of Latvia, Lithuania, and Belarus, using the innovation potential assessment methodology developed by the author

High values of innovation potential result component are obtained only by the counties of Lithuania: Tauragė county (10,00 normalized values), Kaunas county (9,70 normalized values), Vilnius county (9,63 normalized values), Utena county (9,26 normalized values), Telšiai county (8,63 normalized values), Klaipeda county (8,40 normalized values), Šauliai county (7,55 normalized values), Alytus county (7,52 normalized values). Low values of the innovation potential result component are obtained by: Mogilev oblast (0,10 normalized values), Minsk oblast (0,34 normalized values), Grodno oblast (0,63 normalized values), Brest oblast (1,32 normalized values), Gomel oblast (1,74 normalized values), Minsk (2,40 normalized values), Latgale region (2,58 normalized values), Vitebsk oblast (2,72 normalized values).
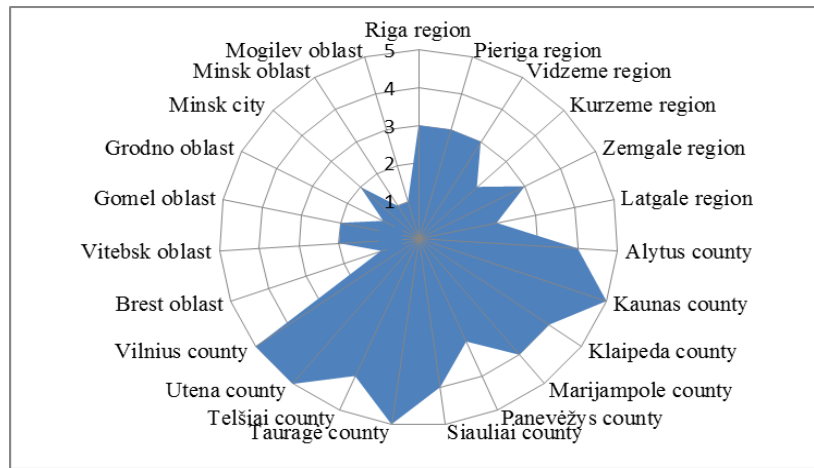
Figure 7. Map of quintile groups of innovation potential result component of regions of Latvia, Lithuania, Belarus
Source: created by the author based on the data of the regions of Latvia, Lithuania, and Belarus, using the innovation potential assessment methodology developed by the author

The first group of quintiles includes Brest oblast, Grodno oblast, Minsk oblast, and Mogilev oblast. The second quintile group includes Kurzeme region, Latgale region, Vitebsk oblast, Gomel oblast, and Minsk city. The third group of quintiles consists of Riga region, Pieriga region, Vidzeme region, Zemgale region, Panevėžys county. The fourth quintile includes Alytus county, Klaipeda county, Marijampole county, Šiauliai county, and Telši county. The fifth quintile includes Kaunas county, Taurage county, Utena county, and Vilnius county.

Evaluation of the innovation potential of the regions of Latvia, Lithuania and Belarus

The author reflects the values of the integral indicator of innovation potential within the range of values [0;10], and its value rows are divided into quintiles.

Table 3. Standardized values and quintile groups of the innovation potential of the regions of Latvia, Lithuania and Belarus

Region	Normalized values	Groups of quintiles
Riga region	9,20	5
Pierina region	6,56	4
Vidzeme region	4,31	3
Kurzeme region	3,93	3
Zemgale region	3,90	3
Latgale region	2,10	2
Alytus county	4,34	3
Kaunas county	7,73	4
Klaipeda county	7,85	5
Marijampole county	4,09	3
Panevėžys county	3,71	2
Siauliai county	4,76	4
Taurage county	5,24	4
Telšiai county	3,79	2
Utena county	4,70	4
Vilnius county	10,00	5
Brest oblast	1,06	1
Vitebsk oblast	1,81	2
Gomel oblast	1,21	2
Grodno oblast	0,60	1
Minsk city	8,51	5
Minsk oblast	0,10	1
Mogilev oblast	0,79	1

Source: author's calculations based on data from the regions of Latvia, Lithuania, and Belarus, using the innovation potential assessment methodology developed by the author

The highest value of the integral indicator of innovation potential is obtained by Vilnius county, and the lowest is by Minsk oblast.
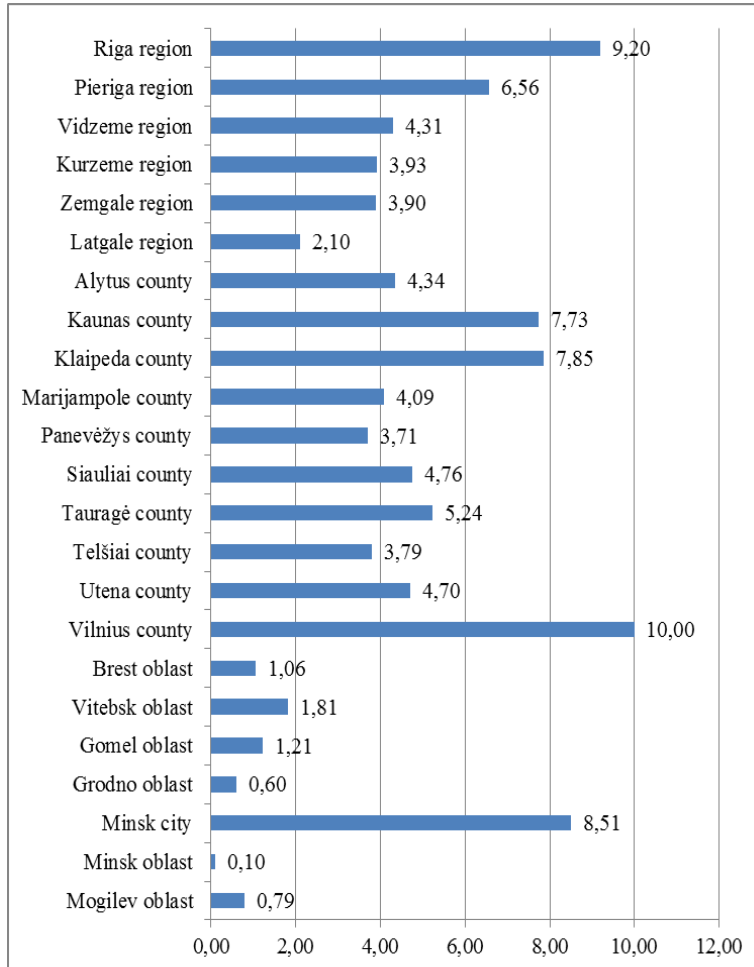

Figure 8. Assessment of the innovation potential of the regions of Latvia, Lithuania and Belarus
Source: created by the author based on the data of the regions of Latvia, Lithuania, and Belarus, using the innovation potential assessment methodology developed by the author

The highest value of innovation potential is obtained by Vilnius county (10.00 standardized values), Riga region (9.20 standardized values), and Minsk city (8.51 standardized values), which are the capital regions. Oblasts obtain the lowest values in Belarus: Minsk oblast (0,10 standardized values), Grodno oblast (0,60 standardized values), Mogilev oblast (0,79 standardized values), Brest oblast (1,06 standardized values), Gomel oblast (1,21 standardized values), Vitebsk oblast (1,81 standardized values).
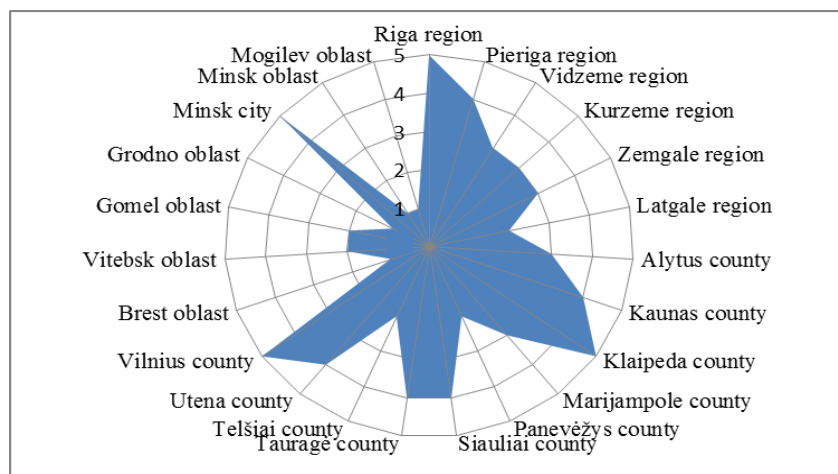
Figure 9. Map of quintile groups of innovation potential of regions of Latvia, Lithuania, Belarus
Source: created by the author based on the data of the regions of Latvia, Lithuania, and Belarus, using the innovation potential assessment methodology developed by the author

The author defines quintile groups of innovation potential. The first quintile group with the lowest innovation potential values includes Brest oblast, Grodno oblast, Minsk oblast, Mogilev oblast. The second group of quintiles includes Latgale region, Panevėžys county, Telšiai county, Vitebsk oblast, Gomel oblast. The third group of quintiles includes Vidzeme region, Kurzeme region, Zemgale region, Alytus county, Marijampole county. The fourth quintile group includes Pieriga region, Kaunas county, Siauliai county, Tauragė county, Utena county. The fifth quintile group with the highest rating includes Riga region, Klaipėda county, Vilnius county and Minsk.

In Belarus, Minsk has a high innovation potential (belongs to the fifth quintile group). Still, the other regions of the country have deficient innovation potential (Vitebsk and Gomel oblasts are in the second quintile group, and Brest, Grodno, Minsk and Mogilev oblasts are in the first quintile group).

Conclusions

Each of the basic approaches for evaluating the innovation potential considers the region's potential at some stage. The application of a specific system is justified under certain conditions; however, within the framework of the given study, it is best to apply a complex method, combining both resource, process and resulting basic approaches.

At the same time, the region's innovation potential should be considered both at the stage of formation and use. This approach allows for determining the resource component and results component of innovative potential. Consequently, the result of using innovation potential will be different types of innovation (new technologies, new types of goods and services).

Each approach (resource, process, result) should be determined as one of the components of the total innovation potential of the regions, which allows for identifying the development problems of the innovation potential, as well as assessing the degree of their influence on the final result, finding ways to solve the identified problems.

From the view of resources, the regions of Riga, Pieriga, Vilnius county, and the city of Minsk get the best rating, i.e. metropolitan regions with a one-way flow of resources towards capitals and other large cities.

The study of the components of innovation potential processes shows that in Latvian, Lithuanian and Belarusian regions, only the city of Minsk ranks in the fifth quintile; the regions of Riga, Pieriga, Kurzeme, Vilnius county and several other counties of Lithuania are in the fourth quintile. The China-Belarus innovation commercialization centre largely determines the place of Minsk in the fifth quintile.

In the fifth and fourth quintiles regions, there is good cooperation between public administration institutions, scientific institutions and business representatives. Other regions should promote the development of interaction between the state, science and business and development cooperation programs that promote the development of innovation potential at the meso-level.

A very high and high level of the resulting component of innovation potential can be observed only in the counties of Lithuania. Vilnius, Utena, Tauragė, and Kaunas counties belong to the fifth quintile group, and Telšiai, Siauliai, Marijampole, Klaipėda and Alytus counties belong to the fourth quintile. Latvian regions get average (Riga, Pieriga, Vidzeme and Zemgale regions) and low (Kurzeme and Latgale regions) values of the resulting component of innovation potential. But the oblasts of Belarus are ranked in the second and first quintiles, which can be assessed as low (Vitebsk, Gomel oblasts, Minsk city) and very low (Grodno, Minsk and Mogilev oblasts) level.

The overall level of innovation potential gets a very high rating (fifth quintile group) in Riga region, Vilnius and Klaipeda counties and Minsk city. Pieriga region, Kaunas, Siauliai, Tauragė, and Utena counties get a high rating (fourth quintile group).

As part of the study, it was found that in regions with high values of the resource component of innovation potential, there are average and low values of the resulting component and the total innovation potential, which low values of the process component can explain.

This certifies that in the given regions, all three components of the innovation potential of the regions exist separately. There is insufficient interaction between them, which is also the biggest obstacle to the region's innovation potential, as well as to the economic development of the region; it hinders the increase of the region's competitiveness and the preservation of market positions and the expansion of market segments.

Research limitations: application of other approaches than chosen by the author might lead to rather differing ranking of considered regions.

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