DATA ARTICLE

CHANGING SIGNIFICANCE OF RUSSIAN REGIONS' RESEARCH AND TECHNOLOGY CAPACITY COMPONENTS

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This article offers data that can be used in comparative studies of research and technology capacity at the level of Russian regions. The database comprises six indicators of the development of personnel-related and financial components of a national research and technology system and research results as evinced in research publications and advanced manufacturing technologies that appeared in 2010—2020. This set of interconnected indicators makes it possible to evaluate Russian regions' research and technology capacity and research output, which affect the degree of development of the innovative environment. The data on regional research output may be of assistance to further regional socio-economic research. The data set includes statistical indicators for 85 Russian regions for 2010—2020, as reported by ROSSTAT. The data on the number off publications and variations therein were obtained from Scopus, the largest unified curated multidisciplinary abstract and citation database. The results are presented as tables and cartographical materials (three tables and six map charts).

Keywords:
research and technology potential, geography of science, scientometrics, research staff, R&D financing

Data specification

Subject	Geography, Planning and Development
Type of data	Tables Figures
Sources of data	Statistical data were obtained from the official statistical information sources, i.e. the Federal State Statistics Service of the Russian Federation (ROSSTAT): Regions of Russia. Social and Economic Indicators and the Unified Interdepartmental Statistical Information System (UISIS). The data on the number of academic publications were exported from the bibliographic and abstracts database of peer-reviewed Scopus journals, with subsequent export to SciVal.
Data format	Raw data Stratified data

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Data collection process	The data collected include several key indicators regarding human and financial resource availability, as well as those characterising results performance in Russian regions. These indicators are commonly used for the assessment of the scientific and technological potential of territories. The data were structured by combining information from statistical information sources and the Scopus database, with a subsequent normalisation of all indicators per 1,000 population.
Location of the regions which provided statistical information	The Central Federal District (18 regions): the Belgorod region, the Bryansk region, the Vladimir region, the Voronezh region, the Ivanovo region, the Kaluga region, the Kostroma region, the Kursk region, the Lipetsk region, the Moscow region, the Oryol region, the Ryazan region, the Smolensk region, the Tver region, the Tula region, the Yaroslavl region and Moscow The Southern Federal District (eight regions): the Republic of Adygea, the Republic of Kalmykia, the Republic of Crimea, the Krasnodar Krai, the Astrakhan region, the Volgograd region, the Rostov region, and the city of Sevastopol The Northwestern Federal District (11 regions): the Republic of Karelia, the Komi Republic, the Arkhangelsk region, the Vologda region, the Kaliningrad region, the Leningrad region, the Murmansk region, the Novgorod region, the Pskov region, the Nenets Autonomous District, and the city of Saint-Petersburg The Far Eastern Federal District (nine regions): the Republic of Sakha (Yakutia), Kamchatka Krai, Primorsky Krai, Khabarovsk Krai, the Amur region, the Magadan region, the Sakhalin region, the Jewish Autonomous Region, and the Chukotka Autonomous District; The Siberian Federal District (12 regions): the Republic of Altai, the Republic of Buryatia, the Republic of Tuva, the Republic of Khakassia, the Altai Krai, the Transbaikal Krai, the Krasnoyarsk Krai, the Irkutsk Region, the Kemerovo Region, the Novosibirsk Region, the Omsk Region, the Tomsk Region; The Ural Federal District (six regions): the Kurgan region, the Sverdlovsk Region, the Tyumen Region, the Chelyabinsk Region, the Khanty-Mansi Autonomous District-Yugra, the Yamal-Nenets Autonomous District; The Volga (Privolzhsky) Federal District (14 regions): the Republic of Bashkortostan, the Republic of Mari-El, the Republic of Mordovia, the Republic of Tatarstan, the Udmurt Republic, the Chuvash Republic, the Kirov Region, the Nizhny Novgorod Region, the Orenburg Region, the Penza Region, the Ulyanovsk Region, the Samara Region, the Saratov Region, the Perm Krai; The North Caucasian Federal District (seven regions): the Republic of Dagestan, the Republic of Ingushetia, the Kabardino-Balkarian Republic, the Karachay-Cherkess Republic, the Republic of North Ossetia-Alania, the Chechen Republic, the Stavropol Krai
Data availability	The data are available in this article and the Mendeley Data Repository: Peker, Irina (2022), “Scientific and technical potential of Russian regions, 2010—2020”, Mendeley Data, V1, doi: 10.17632/3ykgg9mhrs.1

Value of the data

The traditional approach to assessing the scientific and technological potential of a territory involves the analysis of a set of statistical indicators reflecting the availability of resources, as well as the effectiveness of research and development performance, for example, through exploring patent activity [1—3]. In this article, research and development (R&D) is interpreted as a process of generating new knowledge. Performance indicators for this process can be determined by tracking the research productivity of actors, which can be measured, for example, by the number of academic publications [4—8].

This dataset, which includes scientometric indicators, makes it possible to compare the availability of resources and research output of different regions of Russia and to reveal regional characteristics that cannot be identified by analysing conventional indicators commonly used for the assessment of scientific and technological potential. Numerical data on the generation of new knowledge are used in the geography of knowledge and innovation and spatial scientometric methodologies [9; 10].

The datasets compiled can be used by federal and regional authorities when working out programmes and strategies for scientific and technological development, as well as by experts assessing the scientific and technological potential of territories.

Research methodology

Official statistical information obtained from the Federal State Statistics Service was used to compile a set of statistical indicators reflecting the level of resource provision for the development of science and technology, R&D performance and output. The datasets compiled contain socioeconomic indicators for Russian regions: average annual population, engagement in research and development, and R&D expenditures. The data exported from the Unified Interagency Information and Statistics System (UIISS) were used to calculate the share of regional expenditure on research and development as a percentage of the gross regional product.

Building an academic publication database required manually compiling datasets for each region of the Russian Federation, using the advanced search filters of the Scopus database. For this purpose, a list of cities shown in Scopus in the 'Affiliations' section was used (two filters were employed for the search: 'Russia' [5 search hits], i.e., organisations, and 'Russian Federation' [1,560 search hits]). This was done to make a search query for publications by city that would search for all organisations located or affiliated with these cities and having Scopus profiles. This list covers cities, towns, villages and municipal districts. Organisations affiliated with these territorial units were included in the list for further analysis.

After the exclusion of duplicates, 181 cities and towns, 16 villages, 9 municipal districts and 6 urban settlements having research organisations registered in Scopus were identified.

Afterwards, a search query was compiled for each city to obtain information on the number of academic publications. An example of a search query for Kaliningrad is given below:

AFFILCOUNTRY(russia) AND (AFFILCITY(kaliningrad) OR AF-ID("Immanuel Kant Baltic Federal University" 60031254) OR AF-ID("Kaliningrad State University" 60069251) OR AF-ID("Kaliningrad State Technical University" 60018744) OR AF-ID("Baltic State Academy of Fishing Fleet" 60095508) OR AF-ID("All-Union Scientific Research Institute for Synthetic Fibres" 60084534)) AND (LIMIT-TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT-TO (PUBYEAR,2013) OR LIMIT-TO (PUBYEAR,2012) OR LIMIT-TO (PUBYEAR,2011) OR LIMIT-TO (PUBYEAR,2010))*

The publication data for the Russian cities analysed were then grouped by region, according to the official territorial division. In this study, the focus was on academic publications — journal articles, reviews, preprints, conference proceedings, books and chapters — indexed in Elsevier's Scopus database between 2010 and 2020.

Data description

The collected data cover 85 Russian regions and academic publications by R&D organisations affiliated with these regions during 2010—2020. To compare indicators for the Republic of Crimea and the city of Sevastopol, the data were taken for 2020 and 2014. Data collection was conducted from February to March 2020 (the data for 2020 were supplemented by additional information in 2021).

The data are grouped according to the main indicators of the scientific and technological potential of regions: human and financial resources, research performance and output. The indicators used in the database are given in Table 1.

Table 1

Indicators of the scientific and technological potential of a region

Indicator	Calculation	Data source
The number of people engaged in research and development per 1,000 population, people	Calculated as the ratio of the number of people engaged in research and development to the average annual population of the region	Federal Service of State Statistics / Rosstat

The end of the Table 1

Indicator	Calculation	Data source
Number of researchers having academic degrees per 1,000 population, people	Calculated as the ratio of the number of researchers having academic degrees to the average annual number of a region's population	Federal Service of State Statistics / Rosstat
Domestic spending on research and development per 1,000 population, million roubles	Calculated as the ratio of regional spending on research and development to a region's average annual population	Federal Service of State Statistics / Rosstat
Share of regional spending on research and development, % of the gross regional product (GRP)	Raw data	Unified Interagency Information and Statistics System (UIISS)
Advanced production technologies used per 1,000 population, each	Calculated as the ratio of the number of advanced production technologies to a region's average annual population	Federal Service of State Statistics / Rosstat
Number of publications in Scopus-indexed journals per 1,000 population, each	Calculated as the ratio of the number of publications in Scopus-indexed journals to a region's average annual population	Scopus, Federal Service of State Statistics / Rosstat

Since Russian regions vary dramatically in size, the indicators were reduced to their relative values. The absolute indicators were divided by 1,000 population. Figure 1 shows the differentiation of Russian regions according to the number of personnel engaged in research and development per 1,000 population.

Significant positive changes in the number of R&D personnel were revealed in the regions initially having a below average scientific workforce: the Yamal-Nenets Autonomous District, the Republic of Ingushetia, the Republic of Crimea, the Stavropol Krai and the Lipetsk region. In these regions, the average annual rate of growth in scientific personnel exceeds 5 per cent. In contrast, regions initially having a considerable number of R&D personnel saw a slight decline. For example, regions with over 5,000 researchers show a 0.4 per cent decrease in their number annually.

The largest part of the scientific workforce is concentrated in bigger cities: Moscow, St. Petersburg, Nizhny Novgorod, and the Moscow and Tomsk regions. Table 2 demonstrates how Russian regions differ in the number of personnel engaged in R&D per 1,000 population and per employee.

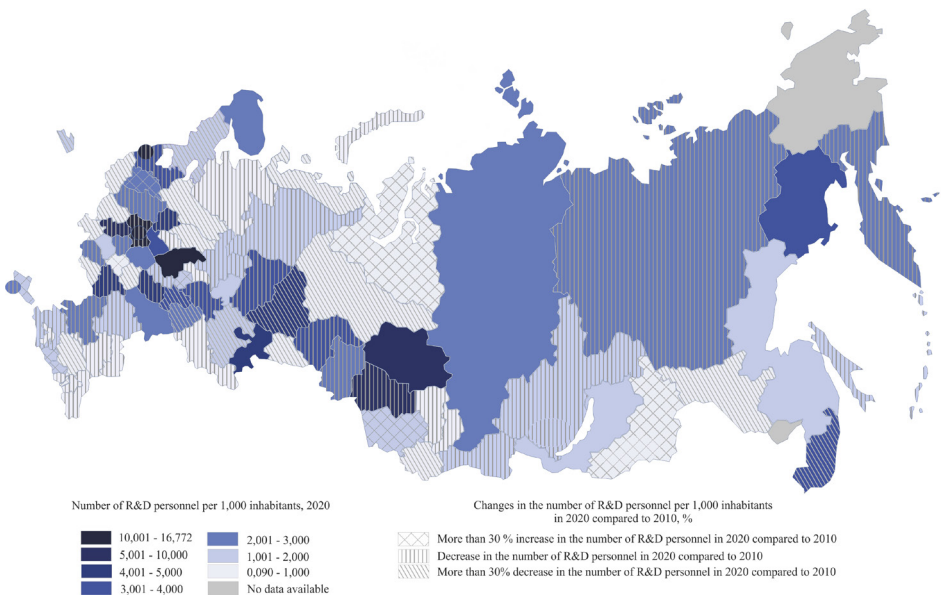

Fig. 1. Number and dynamics of personnel, engaged in research and development in the regions of the Russian Federation, per 1,000 inhabitants, 2010—2020 [11; 12]

Table 2

Distribution of Russian regions by the number of personnel engaged in R&D in 2020, absolute/relative indicators, people [11; 12]

27—1,000 / 0.090—1.000 per 1,000 population	1,001—10,000 / 1.001—4.000 per 1,000 population	1,001—212,441 / 4.001—16.772 per 1,000 population
Central and Northwestern Federal Districts		
The Oryol**, Smolensk, Arkhangelsk, Tambov, Ivanovo, Vologda, Lipetsk, Bryansk, Pskov and Kostroma regions; the Nenets Autonomous District	The Kaluga***, Yaroslavl***, Vladimir, Leningrad, Tula, Tver, Murmansk, Kursk, Novgorod, Ryazan, Belgorod* and Kaliningrad regions; the Republics of Karelia and Komi	Moscow, St. Petersburg; the Moscow and Voronezh regions
Southern, Volga, North Caucasus and Ural Federal Districts		
Republics: Karachay-Cherkess**, Mordovia**, North Ossetia-Alania, Kalmykia, Adygea, Ingushetia, Chechnya, Mari El; the Kurgan, Astrakhan, Orenburg regions; the Yamal-Nenets Autonomous District	The Penza***, Ulyanovsk, Tyumen, Samara, Saratov, Volgograd, Kirov regions; Republics: Bashkortostan, Udmurt, Crimea, Chuvash, Kabardino-Balkaria, Dagestan*; the Perm, Krasnodar, Stavropol* regions; Sevastopol; the Khanty-Mansi Autonomous District-Ugra*	The Nizhny Novgorod, Sverdlovsk, Chelyabinsk and Rostov** regions; the Republic of Tatarstan**

The end of the Table 2

27—1,000 / 0.090—1.000 per 1,000 population	1,001—10,000 / 1.001—4.000 per 1,000 population	1,001—212,441 / 4.001—16.772 per 1,000 population
Siberian and Far Eastern Federal Districts		
Magadan**, Sakhalin**, Amur regions; the Kamchatka**, Transbaikal Krai; the Republics: Tyva, Altai, Khakassia	The Tomsk***, Omsk, Irkutsk, Kemerovo* regions; the Primorsky, Krasnoyarsk, Khabarovsk, and Altai territories; the Republics: Sakha (Yakutia), Buryatia	Novosibirsk Oblast is creating new jobs in manufacturing industry.

Comment: *0.090—1.000 people per 1,000 population; **1.001—4.000 people per 1,000 population; ***4.001—16.772 people per 1,000 population.

Amongst the regions where the number of scientific personnel ranges between 27 and 1,000 people, the relative index is 0.090—1.000 people per 1,000 population. However, some regions in this group are comparable with those having a higher percentage of R&D human resources (for example, the Magadan, Sakhalin and Oryol regions, the Tyva Republic, Mordovia, Karachay-Cherkess and Kamchatka). Regions in the second group have 1.001—4.000 people engaged in research and development per 1,000 population. But the indicators of the Tomsk, Kaluga, Yaroslavl, and Penza regions, which belong to the second group, correspond to those of the third group. The third group, with a scientific personnel of 4.001—16.772 people per 1,000 population, consists of 12 regions with Moscow, St. Petersburg, Nizhny Novgorod, and Moscow regions holding top positions.

Figure 2 shows the number of researchers having academic degrees in Russian regions and changes in the number. Moscow boasts the largest number of researchers with academic degrees. St. Petersburg and the Novosibirsk, Tomsk, Moscow and Magadan regions are also in the leading group. Since 2010, the largest increase in the number of researchers with academic degrees has been registered in the Lipetsk region and the Altai Krai (155 and 135 per cent, respectively). The most considerable decrease in the number of researchers with academic degrees was observed in the Tver, Kaluga, Amur, Sakhalin and Pskov regions, the Chechen Republic and the Khanty-Mansi Autonomous District-Ugra. No correlation was found between the number of researchers having academic degrees and changes in their number. Yet, amongst the regions boasting the largest number of researchers, there is a tendency towards a decrease in the number of academics having various academic degrees.

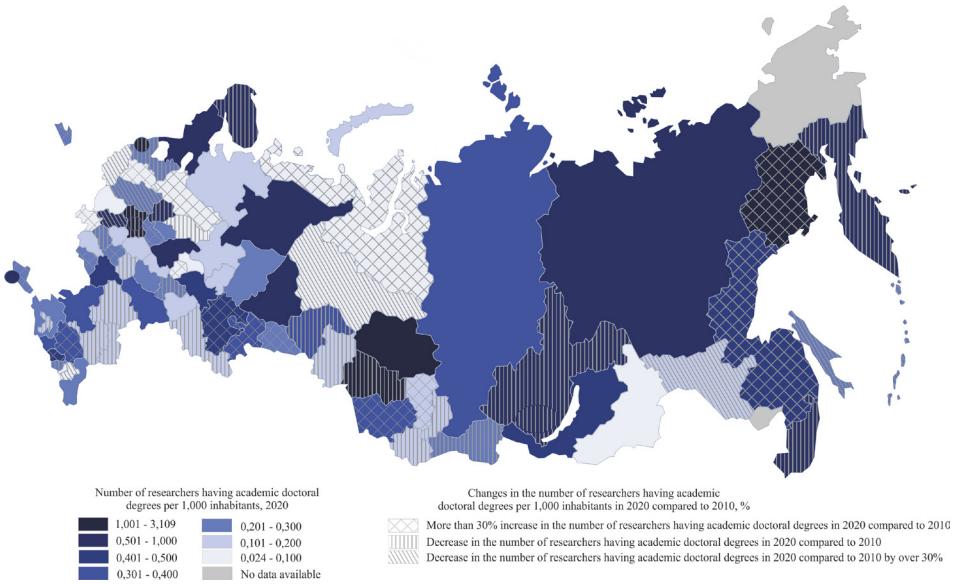

Fig. 2. Number and dynamics of researchers having doctoral degrees in Russian regions per 1,000 inhabitants, 2010—2020 [11; 12]

In contrast to scientific personnel potential, the volume of R&D funding is annually growing in Russia. Since 2010, domestic spending on research and development has more than doubled, and the average annual growth of the volume of funding has reached 8.5 per cent.

Figure 3 presents the distribution of Russian regions by the volume of domestic spending on R&D. The analysis of the distribution of R&D expenditures per 1,000 population shows that Moscow, the Nizhny Novgorod Region, St. Petersburg, and the Moscow Region spend more on R&D than other territories in their group. Most regions recorded an increase in spending on research and development, except the Kaluga region (a 9.7 per cent reduction in 2020 in comparison with 2010) and the Nenets Autonomous District (a 19.6 per cent decrease). The Yamal-Nenets Autonomous District, Sevastopol, the Lipetsk region, the Republic of Crimea, the Republic of Ingushetia and the Pskov Region had the highest average annual growth in R&D spending. The average annual growth in R&D domestic spending in the rest of the regions was below 20 per cent.

Table 3 presents the distribution of Russian regions according to absolute and relative indicators of R&D expenditures. The first group includes 27 regions with the lowest R&D spending. Yet, in 2020, Magadan invested an impressive 5,836 million roubles per 1,000 population in R&D, placing the region in the third group. The Kaluga, Tula, Yaroslavl regions and the Kamchatka Krai also belong to the third group according to the relative volume of R&D expenditures.

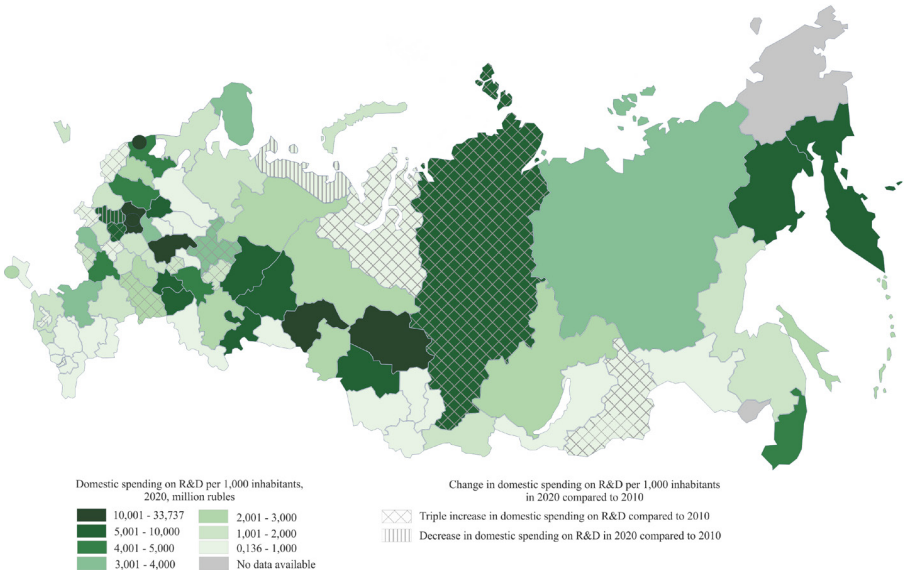

Fig. 3. Volume and dynamics of domestic spending on research and development per 1,000 inhabitants, 2010—2020 [11; 12]

Table 3

Distribution of Russian regions by the volume of R&D spending, absolute and relative indicators, million roubles, 2020

32.1 — 1,000.0 / 0.136 — 1.000 per 1,000 population	1,000.0 — 10,000.0 / 1.001 — 5.000 per 1,000 population	10,000.1 — 427,329.3 / 5.001 — 33.737 per 1,000 population
Central and Northwestern Federal Districts		
The Vologda, Ivanovo, Oryol**, Bryansk, Pskov, and Kostroma regions; the Nenets Autonomous District	The Leningrad, Tver, Tula***, Kursk, Yaroslavl***, Kaluga***, Smolensk, Vladimir, Tambov, Belgorod, Murmansk, Kaliningrad, Arkhangelsk, Ryazan, Novgorod, Lipetsk* regions; the Komi Republic	Moscow, St. Petersburg; the Moscow and Voronezh** regions
Southern, Volga and North Caucasus Federal Districts, Ural Federal Districts		
The Orenburg, Kurgan, and Astrakhan regions; the Republics of Kabardino-Balkaria, Karachay-Cherkess**, the Chechen Republic, North Ossetia-Alania, Adygea, Mari El, Kalmykia, and Ingushetia; the Yamal-Nenets Autonomous District	The Saratov, Volgograd, Penza, Kirov regions; the Krasnodar, Stavropol* regions; the Republics: Chuvash, Udmurt, Crimea*, Dagestan*, Mordovia; the Khanty-Mansi Autonomous District — Ugra; the city of Sevastopol	The Nizhny Novgorod, Samara, Chelyabinsk, Tyumen, Sverdlovsk, Rostov**, Ulyanovsk regions; the Republics of Tatarstan**, Bashkortostan**; the Perm Krai

The end of the Table 3

32.1 — 1,000.0 / 0.136 — 1.000 per 1,000 population	1,000.0 — 10,000.0 / 1.001 — 5.000 per 1,000 population	10,000.1 — 427,329.3 / 5.001 — 33.737 per 1,000 population
Siberian, Far Eastern Federal Districts		
The Magadan***, Amur Region; the Republics of Buryatia, Tyva**, Altai, and Khakassia; the Transbaikal Krai	The Irkutsk, Omsk, Sakhalin, Kemerovo* regions; the Khabarovsk, Altai*, Kamchatka** Territories; the Republic of Sakha (Yakutia)	The Novosibirsk and Tomsk Regions; the Krasnoyarsk Krai

The share of domestic spending on R&D in the GRP does not correlate with the total volume of R&D expenditures. At the forefront is the Nizhny Novgorod region, where 5.5 per cent of the GRP was spent on research and development in 2020. At the same time, according to its natural value, the region holds the fourth place, following Moscow, the Moscow Region and St Petersburg (Fig. 4). In most Russian regions, R&D spending accounts for less than 1.0 per cent of the GRP.

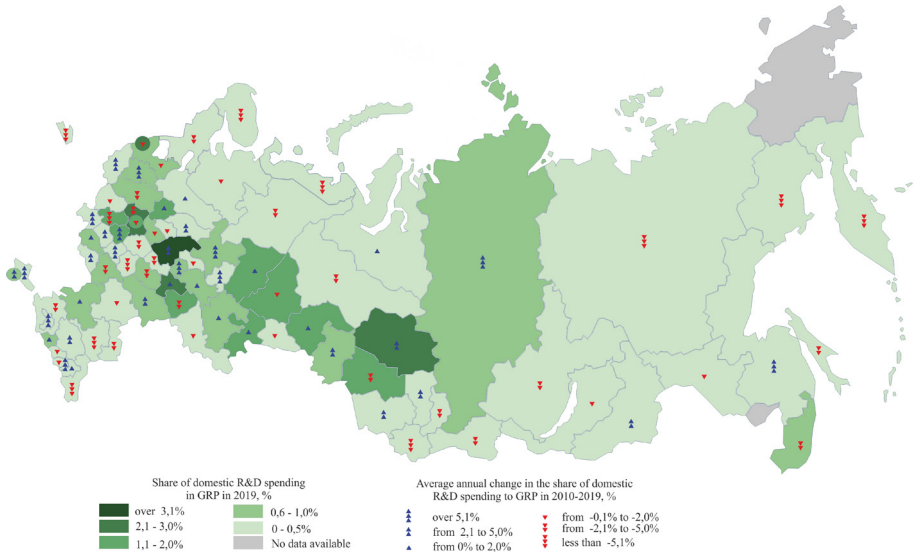

Fig. 4. Share and dynamics of domestic spending to GRP, 2010—2019 [11; 12; UISIS[1]]

Figure 5 illustrates the distribution of Russian regions according to the number of publications indexed in the Scopus database per 1,000 population. In 2020, the leaders in the total number of publications were the Tomsk region, Moscow, the Novosibirsk region, St. Petersburg and the Sverdlovsk region. A rise in the number of academic publications was observed in all regions of the Russian Federation, with the most intensive growth was recorded in the Yamal-Nenets Autonomous District, the Chechen Republic, the Kirov region, the Republics of Adygea and Khakassia.

[1] Unified Interdepartmental Statistical Information System (UISIS), 2019, URL: https://www.fedstat.ru/ (accessed 15.04.2020).

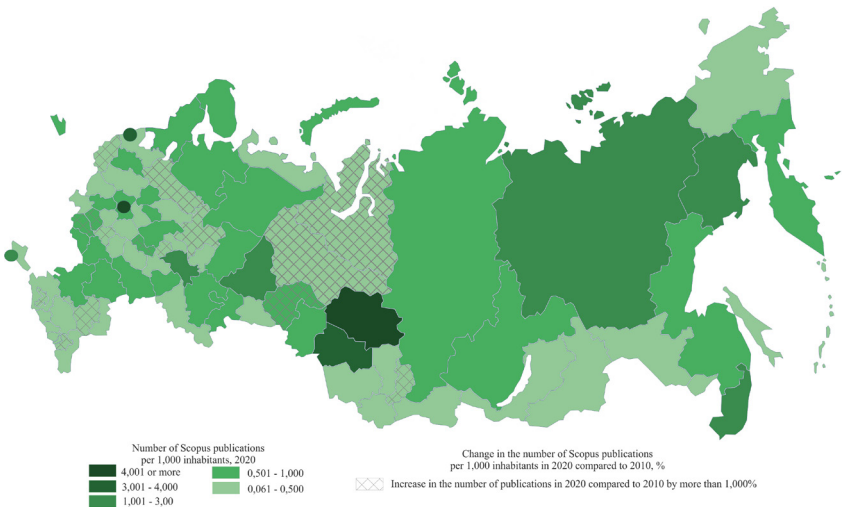

Fig. 5. Volume and dynamics of the number of scientific publications indexed in the Scopus database, per 1,000 inhabitants, 2010—2020 [11; 12; Scopus[2]]

Figure 6 shows the distribution of Russian regions according to the number of advanced production technologies used per 1,000 population in 2020. The most extensive use of advanced technologies was registered in the highly developed raw material region — the Yamal-Nenets Autonomous District, as well as in several industrial regions: the Perm Krai, the Vladimir region and the Udmurt Republic.

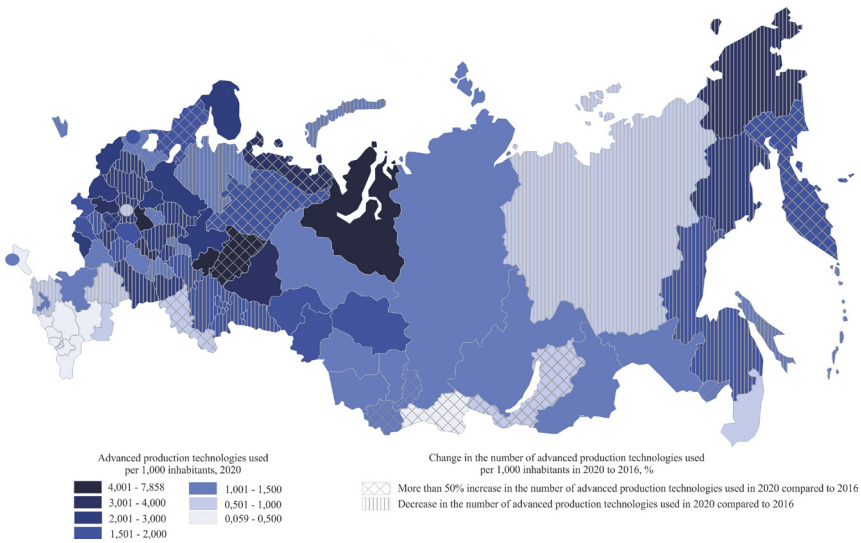

Fig. 6. Volume and dynamics of the number of advanced production technologies used per 1,000 inhabitants, 2010—2020 [11; 12; Scopus[3]]

The data collected include several key indicators of the scientific and technological potential of Russian regions: the availability of human resources, ac-

[2] Scopus, 2010—2020, URL: https://www.scopus.com (accessed 15.04.2020).

[3] Ibid.

ademic degrees of researchers, research and development funding, publication activity, as well as the use of advanced manufacturing technologies in Russian regions.

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