

**ICEST 2021****II International Conference on Economic and Social Trends for Sustainability of Modern Society****DETERMINATION OF PRIORITY AREAS FOR THE CREATION  
OF WORLD-CLASS SCIENTIFIC CENTERS**

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**Abstract**

In this study, the author shows the need to create new world-class scientific centers in addition to those already created within the framework of the national project "Science". In the course of the study, a bibliometric analysis of the data of the Web of Science Incites system was carried out, according to the results of which the top 25 scientific areas with the largest number of publications in the world in 5 years were identified, the so-called world scientific fronts. Further, the world top 25 was compared with a similar Russian rating and the general highest priority areas were highlighted. In addition, the author compiled a Russian rating of publications with the highest citation rate "hot papers". This rating showed in which areas in Russia the most relevant articles are published, which in turn indicates the presence of highly qualified scientists in these areas in our country. Comparing the ratings obtained, the author of the article identified priority areas for the creation of world-class scientific centers, excluding the areas for which the centers have already been created. Further, the author showed the commercial potential of scientific results that can be obtained in the selected areas by building a rating of technological areas by the number of patents issued in the world and on the territory of Russia and distributing them according to the selected scientific areas.

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## 1. Introduction

The priority task of state policy in most countries is the development of science and technology. The Russian Federation has historically been one of the world's scientific powers: domestic scientific and engineering schools effectively solved the problems of socio-economic development and security of the country, made a significant contribution to the accumulation of scientific knowledge by mankind and the creation of advanced technologies. The importance of the scientific and technological development of Russia is emphasized at the highest state level. The President of the Russian Federation approved the Strategy for the Scientific and Technological Development of the Russian Federation, the main goal of which is to ensure the independence and competitiveness of our country through the effective use of the intellectual potential of the nation (Chistyakova, 2020).

To implement the strategy of scientific and technological development of the Russian Federation, national projects have been launched, one of which is the national project "Science" (Petrov & Kurakova, 2019). As part of the implementation of task 2 "Creation of world-class scientific centers, including a network of international mathematical centers and centers for genomic research" of the federal project "Development of scientific and scientific-industrial cooperation" of the national project "Science" in 2019 and 2020, as a result of competitive selection, 17 world-class research centers (hereinafter - WCRC) have been selected, which include: 4 international mathematical centers, 3 centers for genomic research and 10 WCRC working in priority areas (Kamenskikh, 2020). The centers are created in order to carry out breakthrough research, mainly of a fundamental and exploratory nature, aimed at solving problems corresponding to the world level of relevance and significance.

## 2. Problem Statement

As of 2021, 17 WCRC have been created in areas important for Russia. At the same time, the need to create additional centers has not been determined. In this scientific research, the author identified priority areas for the creation of WCRC in Russia, excluding the areas in which the centers have already been created.

## 3. Research Questions

In course of the study the following questions were raised:

- The need to create new WCRC?
- Priority areas for the creation of WCRC?
- Criteria for determining priority areas?

## 4. Purpose of the Study

Identify priority areas for the creation of WCRC in Russia, excluding the areas in which the centers have already been created.

## 5. Research Methods

To conduct the research, the author used the following approaches:

- Analysis of the report on the development of technologies and innovations in 2018. United Nations Conference on Trade and Development (UNCTAD).
- Identification of priority research areas (research fronts) for:
  1. Identification of priority technological areas by analysing the dynamics of granting patents in technological areas by Russian and foreign applicants (world / Russia).
- "hot papers" - publications that are rapidly and actively gaining citations (world / Russia),
- dynamics of the number of publications (world / Russia).

## 6. Findings

We will conduct a bibliometric analysis of publication activity using the Web of Science Incites analytics system. We will determine the most promising scientific directions by examining the scientific fronts of Russia and the world and their correlation. Table 1 below shows the ranking of scientific directions by the number of publications for 2016-2020. The second column presents the rating in the world, in the third column is the place of Russia in these areas. The column "Hot papers Russia" shows the place of Russia in the listed areas for publications of hot papers. Hot papers are papers that receive a large number of citations soon after publication, relative to other papers of the same field and age. More precisely, they are papers published in the past two years that received a number of citations in the most recent two-month period that places them in the top 0.1% of papers in the same field (Jacob et al., 2015).

Please replace this text with context of your paper. The descriptive statistics are presented in the Table 1.

**Table 1.** Ranking of scientific directions by the number of publications, 2016-2020

Research Area	Rank World	Rank Russia	Hot papers Russia
Engineering, electrical & electronic	1	3	-
Materials science, multidisciplinary	2	2	10
Oncology	3	-	1
Chemistry, multidisciplinary	4	6	19
Physics, applied	5	1	-
Biochemistry & molecular biology	6	10	19
Environmental sciences	7	-	-
Chemistry, physical	8	7	19
Surgery	9	-	-
Neurosciences	10	-	-
Clinical neurology	11	-	6
Pharmacology & pharmacy	12	-	-

Computer science, theory & methods	13	21	-
Energy & fuels	14	25	10
Public, environmental & occupational health	15	-	-
Cardiac & cardiovascular systems	16	-	5
Computer science, information systems	17	-	-
Telecommunications	18	-	-
Artificial intelligence	19	-	-
Education & educational research	20	17	-
Cell biology	21	-	8
Optics	22	4	-
Nanoscience & nanotechnology	23	18	-
Engineering, chemical	24	24	-
Medicine, research & experimental	25	-	-

It follows from the table that the natural sciences are generally included in the top 25 scientific areas of the world. Russian authors have a large number of publications in 12 priority scientific areas in the world. In 9 areas, articles by Russian scientists are highly cited and fall under the category of "hot papers". Of these, 4 areas have a low rate of publications among Russian scientists, however, the high citation rate of these publications indicates the presence of highly qualified Russian specialists with relevant knowledge in these areas of science: oncology, clinical neurology, cardiac & cardiovascular systems, and cell biology.

Based on the results of the bibliometric analysis of the statistical data of the analytical system Web of Science Incites, it is possible to single out criteria characterizing the scientific areas in which it is advisable to open world-class scientific centers in Russia. These include:

- a large number of publications with Russian affiliation in a priority scientific area in the world;
- high citation rate of scientific publications, which indicates the relevance of the information and the high qualifications of the authors;
- the absence of already established WCRC in scientific areas that meet the specified criteria.

Using these criteria, it is possible to determine the scientific areas in which it is advisable to create a WCRC, since these areas are priority in the world and Russia, and in these areas there are relevant scientific works from highly qualified scientists.

At the same time, one should pay attention to the fact that WCRC has already been created in several scientific areas. In particular, in the field of mathematics, physics and related sciences, 4 International Math Centers and the WCRC "Photonics Center" were created, in the fields of medicine and microbiology, 4 WCRCs were created, as well as 3 centers for genomic research, in the fields of energy resources, 1 WCRC was created, in the humanities 1 WCRC was created (Zhernov, 2020).

From this it follows that the promising "free" priority areas for the creation of WCRC include: engineering, electrical & electronic, chemistry, nanoscience & nanotechnology.

This conclusion is confirmed by the analysis of patent activity in the world and in Russia. In particular, Table 2 presents the rating of obtaining patents by technology industry for 2017-2019 in the world and a place in Russia in these areas.

**Table 2.** Ranking of granting patents by technology industry, 2017-2019

Technology industry	Rank World	Rank Russia
Computer technologies	1	15
Electrical equipment, power engineering	2	11
Digital communication	3	32
Measurement	4	1
Transport	5	5
Medical technology	6	2
Civil Engineering	7	3
Semiconductors	8	24
Audio-visual technology	9	33
Special equipment	10	4
Mechanical elements	11	8
Machine tools	12	17
Engines, pumps, turbines	13	10
Pharmaceuticals	14	6
Optics	15	28
Treatment	16	29
Materials, metallurgy	17	7
Telecommunications	18	22
Chemistry of materials	19	14
Chemistry technology	20	9
Equipment, games	21	25
Fine organic chemistry	22	18
The control	23	20
Biotechnology	24	19
Common consumption goods	25	27

We will distribute the technology industries according to the selected, after bibliometric analysis, scientific areas of priority for the creation of the WCRC (Table 3).

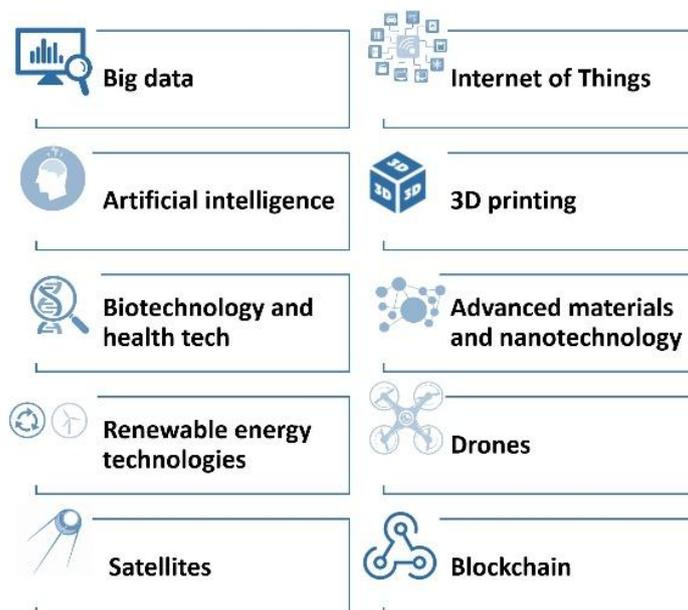
**Table 3.** Distribution of technology industries by scientific areas

Column Heading	Column Heading
	Computer technologies
	Electrical equipment, power engineering
	Digital communication
	Measurement
	Transport
Engineering, electrical & electronic	Semiconductors
	Audiovisual technology
	Special equipment
	Mechanical elements
	Machine tools
	Engines, pumps, turbines

	Telecommunications Equipment, games The control Pharmaceuticals
Chemistry	Chemistry of materials Chemistry technology Fine organic chemistry
Nanoscience & nanotechnology	Computer technologies Electrical equipment, power engineering Digital communication Semiconductors Telecommunications Equipment, games

Table 3 shows that the technology industries for which the most patents have been obtained fit well into the selected research areas. This fact suggests that the fundamental research to be carried out by the created WCRC is related to applied science and has the potential for commercialization, which is important both for scientific and technological development, and for the production and economy of the country.

In 2018, at the United Nations Conference on Trade and Development (UNCTAD), the technology and innovation report highlighted the main advanced technologies that have an impact on the development of fundamental research (Figure 1).



**Figure 1.** Key technologies

Scientific research aimed at studying these technologies, according to UN experts, is the most priority for the scientific and technological development of any country. Priority research areas, selected based on the results of bibliometric analysis, are the best suited for the study of these technologies. In particular, within the framework of engineering, electrical & electronic and nanoscience & nanotechnology, the following technologies can be studied: big data, the internet of things, artificial intelligence, 3D printing,

satellites and drones, advanced materials and nanotechnology, blockchain. Within the chemistry direction: biotechnology and health tech, renewable energy technologies, advanced materials.

## 7. Conclusion

The author of the article conducted a study within the framework of which three priority scientific directions were identified for the creation of WCRC within the framework of the national project "Science": engineering, electrical & electronic, environmental sciences, nanoscience & nanotechnology, chemistry.

These areas are relevant scientific fronts, on which over the past 5 years more articles have been published in the world and in our country. In addition, Russian scientists with articles in these areas are highly cited, which indicates the relevance of the published material and the high qualifications of the authors.

Also, the scientific results obtained in these areas have a great potential for commercialization and, potentially, can be in demand by organizations in the real sector of the economy.

The author of the study proposes to create 3 WCRC in each of the identified areas. This will make it possible not only to strengthen Russian science, but also to strengthen its position in the world scientific and technological arena.

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