

# Technoparks as Centers of Regional Economic Development



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**Abstract:** *In the modern world, socio-economic and political leadership of a country is based on the generation of new knowledge, its commercialization and use in all areas of human activity, it being an important prerequisite for improving the competitiveness of the state. To achieve this goal, individual elements of the national innovation system including the main components of the innovation infrastructure are being formed in many constituent entities of the Russian Federation. The article discusses an important component of the industrial and technological innovation infrastructure - technology parks. The dynamics of technology parks development in Russia since 1990, their functions, specialization and efficiency of functioning are revealed. The conclusion is made about how the increasing number of technology parks influences on socio-economic and innovative development of the regions in Russia. Further development of regional innovation systems based on the development of technology parks in the field of high technologies is associated with the development of effective marketing mechanisms for the commercialization of innovations, improving the quality of education and its focus on innovation issues. The applied focus of scientific research should be accompanied by the diversification of the innovation-technological complex in accordance with the priority directions of technological development of regions and country. The results of the research can be used by decision makers to substantiate the diversification of regional innovation systems in accordance with the priority directions of the technological development of the country.*

**Keywords :** *innovation, productive and technological infrastructure, region, diversification, technopark.*

## I. INTRODUCTION

The main strategic priority of modern economic policy of Russia is to increase the level of innovative development of the country which is achievable only with the active promotion of this process at the regional level. Socio-economic and geopolitical leadership of Russia in the modern world is possible only through the generation of new knowledge, its commercialization and use in all areas of human activities. It is an important prerequisite for improving the competitiveness of the state.

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To achieve this goal, in many constituent entities of the Russian Federation separate elements of the national innovation system are being formed, the quality of institutional mechanisms is improving, the number of innovation infrastructure objects is increasing, the patent and publication activity of researchers, etc. is increasing [1, 2].

The most important prerequisite for raising the level of innovation development in the region is the quality of regional innovation policy, potential of research and advanced development (R&D), indices of effectiveness and socio-economic conditions of innovation activity. This is largely due to the level of the relevant infrastructure development. The importance of the infrastructure factor is evidenced by the experience of innovative leading regions - Moscow, St. Petersburg, the Republic of Tatarstan, Moscow and Sverdlovsk regions which have the most intensive and diversified system of innovation infrastructure. An important component of the innovation infrastructure is technology parks which are necessary for generating new ideas and scientific developments and transforming them into new technologies, pilot and serial samples of products. Technoparks often become the basis for business start-ups and development of high-tech companies that form the basis of regions and countries innovative development.

## II. METHODOLOGY

To understand the role of technoparks in the socio-economic development of regions and countries, publications summarizing knowledge in the field of research on innovation activities are of great importance. One of such works is the monograph by V. L. Baburin and S. P. Zemtsov «The Innovative Potential of the Regions of Russia» [1]. This study examines the methods of analyzing regional innovation potential, identifies and explains the spatial and temporal patterns of innovation in the regions of Russia. The authors have developed theoretical and methodological foundations and proposed methodological tools for studying regional factors of innovation activity, the processes of innovations diffusion and their spatial modeling. Another synthesis work is «Synergy in space: Regional Innovation Systems, Clusters and Knowledge Flows» [3]. This study contains publications by leading Russian, European and American scientists in the field of regional innovation research. The authors analyze peculiar features of innovation process in different countries and regions. Particular attention is paid to the formation of technology parks, the largest territorial innovation clusters in Europe and America are considered.



## Technoparks as Centers of Regional Economic Development

It is emphasized that one of the most important direction of cluster policy is the establishment of technology parks that provide the territorial concentration of intellectual, material, technical and financial resources necessary for the clustering process as the basis for the development of high-tech industries. In most modern studies of technology parks as an object of innovation infrastructure, the following aspects of their study are considered [4]: the role of science and industrial parks as an important source of countries socio-economic growth and their particular regions; analysis of various options for organizational and functional structure of technology parks and their territorial differentiation in different countries and regions of the world. Foreign studies devoted to the research of innovation infrastructure emphasize its role as the main factor in the innovative development of regions and improving population's quality of life, provide modeling algorithms and assessment of production-technological infrastructure importance [5, 6, 7]. The formation of technology parks and innovation clusters in Europe, North and Latin America is considered as an important mechanism for level alignment of socio-economic development of regions within the country [8]. There are research works that study in great detail the formation and development of territorial innovation clusters in economically developed countries and consider their influence on the formation of knowledge-based economy [9, 10]. Chinese researchers analyze the experience of creating science parks and other infrastructure facilities as a prerequisite for the transformation of centrally state-planned economy regions into innovative regions [11].

The object of the research is the technology parks of the Russian Federation regions; the subject is the qualitative and quantitative characteristics of their main components. We have used the results of the ranking of innovative regions of Russia conducted by the Higher School of Economics (HSE) [12] and the Association of Innovative Regions of Russia (AIRR) [13]. The components and main characteristics of the objects of production-technological infrastructure are presented on the website «Innovations of Russia» [14] and in the studies conducted by the Association of Clusters and Technoparks of Russia [15]. In 2018 the Association presented the results of the 4th National Technopark Rating of Russia the purpose of which is to identify mechanisms for the effective management of technoparks and successful work experience of technoparks residents. All participating technology parks were divided into 4 groups according to the level of technology park efficiency: the highest, high, moderately high and sufficient. Additional information was obtained on the sites of large Russian technology parks, including data on specialization, economic performance, number of residents, etc.

The informational basis of the research is the official statistical information from the Federal State Statistics Service [16], the HSE, AIRR, normative-legal acts of the federal and regional levels.

The purpose of the study is to identify and study the basic laws of founding, formation, functioning of technoparks and determine further trends in their development.

In order to do this we have dealt with the following issues:

- verification of the concept of «technopark», the definition of its main functions;
- consideration of the history of technology parks founding and formation in the world and Russia;
- evaluation of technology parks effectiveness;
- analysis of Russian technology parks specialization;
- identification of how territorial concentration of technology parks influence the main indicators of innovation activity in the regions.

### III. RESULT AND DISCUSSION

One of the most effective tools that stimulate the development and introduction of advanced production technologies and the production of new types of competitive products are technology parks that provide businesses with access to unique production and technological equipment and services. Technopark is an organizationally defined compact territory where favorable conditions are created to support high-tech business by locating innovative companies, research centers and laboratories, equipment and instruments for research and technology development in order to commercialize their results [17]. Technoparks are provided with a whole range of services for respondents: engineering and information services, offices, individually equipped workplaces, laboratories, assembly rooms, warehouses, etc.

Technoparks, like other elements of the innovation infrastructure, perform the following functions:

1. Agglomerative. The territorial concentration of financial flows, material and technical, and intellectual resources for the development of innovative projects implementation.
2. Pilot and experimental. Approbation of scientific developments and mechanisms of innovative development.
3. Organizational. Interaction between science, business, production and power.
4. Stimulating. Formation of creative environment, providing certain guarantees to the business.
5. Standardizing. Creating universal technical solutions, technologies, models.
6. Diffusion. Spreading innovation across the territory.
7. Informative. Information support for innovations.

There are more than 700 technology parks in total in the world of which the largest number is located in the USA, Western Europe and China (about 87%). The first technology parks in the form of science parks emerged in the United States in the early 1950s based at Stanford University. Their main task was to commercialize the results of intellectual activity of talented scientists from scientific laboratories. In the early 2000s there were already more than 200 science parks in the US. They often became the basis for the creation of large high-tech companies. Such large companies as Hewlett-Packard, General Electric, Eastman Kodak, Lockheed emerged from technoparks. Such companies as Apple Inc., Symantec, Intel, AMD, Google, Cisco, NVIDIA, eBay, Yahoo are residents of technoparks.

In Europe the first technology parks were founded in the 1970s: Great Britain (The Trinity College Science Park in Cambridge),



France (Sophia-Antipolis in Nice) and Belgium (Leven-la-Neuve) [17]. The dynamic development of technology parks in Europe began in the 1980s and currently there are more than 250.

In Russia the first technology parks were founded in the 1990s. At the same time prototypes of modern technology parks existed in the USSR.

The first technopolis can be considered the Siberian Akademgorodok in Novosibirsk which received this status as early as in 1957. Modern Russian technology parks began to be established in the early 1990s on the basis of higher educational institutions.

The first technology parks began to form in modern Russia in the early 1990s. In 1990 in the city of Tomsk (in the Western Siberia) was created the first technology park (technopark) – «Tomsk Science and Technology Park». In the early 1990s on the basis of the leading universities of Russia (Moscow State University named after Lomonosov, St.

Petersburg State Electrotechnical University, Moscow State Energy University, Moscow State Engineering and Physical University, etc.) several dozen of technoparks appeared and by 1993 there were 43 of them. In the years since their number has significantly decreased as a result of absence of a well-considered and effective state strategy in the field of technoparks founding and their development, weak financial support and by 2006 only four functioning technoparks left.

From 2006 to the present the second stage of a large-scale establishment and development of technoparks in Russia has been carried out which is associated with the implementation of a targeted state policy on the formation of a national innovation system. At the federal level implementation of targeted programs for the development of technology parks in the country has been launched. Currently, there are about 160 technology parks in Russia and more than ten are at the stage of formation (Fig. 1).

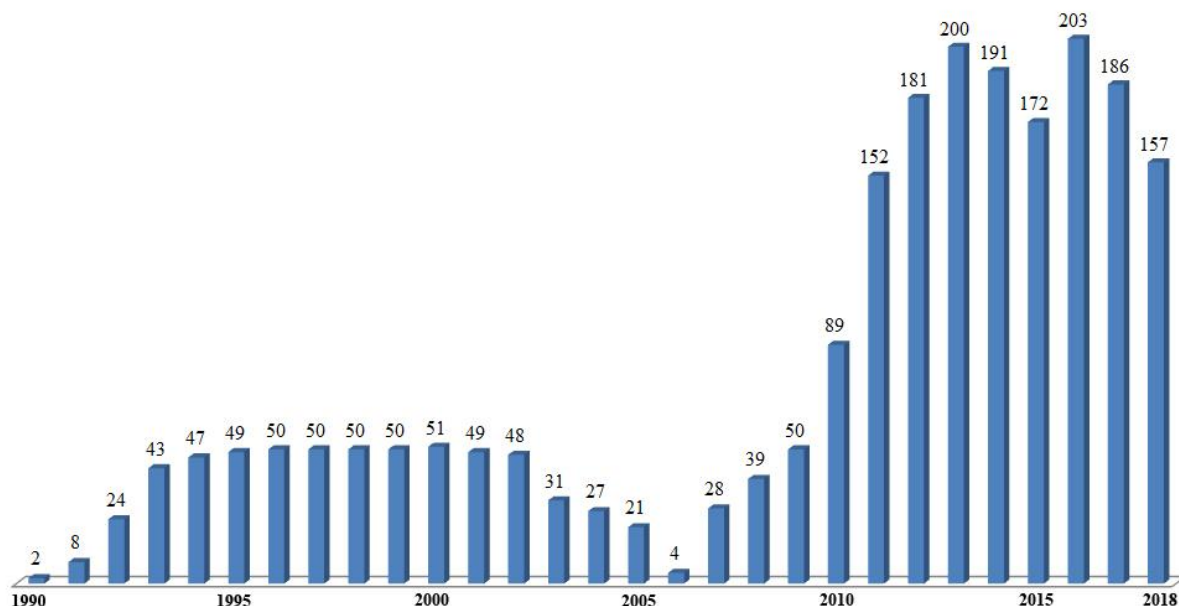


Fig. 1. Dynamics of Russian technology parks establishing, 1990-2018, units [15].

In 2011 the Association for the Development of Clusters and Technoparks of Russia was established which brings together objects of industrial and technological infrastructure. The association includes 42 regions of Russia and more than 80 members. About 200 thousand people work at the enterprises belonging to the Association, the volume of manufactured innovative products is 0.8% of Russia's GDP [15]. According to the Association there are currently about 157 technology parks in 53 regions of Russia. The largest number of technology parks is represented in Moscow (38), Moscow region (19) and Sverdlovsk region (8), St. Petersburg (7) and the Republic of Tatarstan (6). At the beginning of 2018 technology parks occupied an area of 1,489 hectares, the number of registered residents was 4833 units, the cumulative revenue of residents of technology parks was about \$ 4

billion, the number of intellectual property objects registered by residents of technology parks was 1065 units. According to the forms of ownership technoparks were distributed as follows: state - 35%, private - 52%, mixed - 13% [15].

Since 2015 the Association has evaluated the performance appraisal of technology parks. It is carried out in 4 main blocks: innovative activity of technopark's residents; economic activity of technopark's residents; the performance of technopark's management company; investment attractiveness and information transparency of technopark. The results of this assessment are published annually in the form of ranking of technology parks in Russia [15]. Technology parks performance rating results for 2018 are given in table 1.



**Table -I: Tjp 10 technoparks of Russia with the highest level of efficiency**

Ranking	Name (Location)	Main areas of specialization
1.	Nanotechnology Center «Techno-Spark» (Moscow)	Multi-Sectoral (laser technology, technology based on new carbon materials, HVM lithography technology, production technology of CVD-diamond products, nuclear medicine)
2.	Technopark in the sphere of high technologies in the Republic of Mordovia (Republic of Mordovia)	Multi-Sectoral (instrumentation, optoelectronics and fiber optics, energy-saving lighting, nano- and composite materials, IT-technology, biotechnology)
3.	Nanotechnology Center «SYGMA. Novosibirsk» (Novosibirsk Region)	Multi-Sectoral (nano-modified metals and alloys, ceramic materials, biomedical technology and regenerative medicine)
4.	Technopark «Kalibr» (Moscow)	Multi-Sectoral (instrumentation, additive technologies, self-driving car and electric transport, IT-technology, intelligent control systems in light industry)
5.	Scientific and technological park of the Novosibirsk Akademgorodok «Akademgorodok» (Novosibirsk Region)	Multi-Sectoral (instrumentation, IT-technology, industrial biotechnology, development of new drugs, equipment for medicine and biotechnology, synthesis of carbon nanotubes)
6.	Industrial Technopark «Leader» (Moscow Region)	Production of high-tech medical equipment, electronics, computing technology
7.	Technopark in the sphere of high technologies «Zhiguli valley» (Samara Region)	Multi-Sectoral (IT-technology, development of multiprocessor computers with parallel structure, aviation and space technology, navigation systems, biotechnology, robotic systems and flexible production systems, energy saving devices, development of composites and polymers)
8.	Innovation and Production Technopark «IDEA» (Republic of Tatarstan)	Multi-Sectoral (nanoreagent oil-well treatment, ultrasound equipment for enhanced oil recovery, methods of cleaning and restoring soil after oil pollution, membrane engineering)
9.	Technopark «Sarov» (Nizhny Novgorod Region)	Multi-Sectoral (IT-technology, laser technologies, energy efficient technologies, sensors and automation, materials and coatings)
10.	Ulyanovsk Technology Transfer Center (Ulyanovsk Nanocenter ULNANOTECH) (Ulyanovsk Region)	Multi-Sectoral (alternative energy sources, biotechnology and molecular genetics, microelectronics, new construction technologies)

Compiled by: [14, 15]

10 technology parks have the highest performance indicators and have the following distribution by regions: Moscow and Nizhny Novgorod Regions – 2, the Republic of Mordovia and Tatarstan, Moscow, Novosibirsk, Samara, and Ulyanovsk Regions – 1. The vast majority of high-performance technology parks are of the Greenfield site type that is they were built in a new territory that was not previously built up and does not have the original infrastructure. The form of ownership of technology parks management company among the rating leaders: state – 4, private – 4, mixed – 2.

To analyze the degree of influence of regions with the highest concentration of technology parks on the level of innovative development of the country, five regions were analyzed, where 40 out of 157 technology parks of Russia are concentrated (Table 2).

Technoparks of Russia have significantly different specialization [18]. There are five main areas of specialization of technology parks: information technologies (intelligent management systems, intelligent image recognition systems, virtual geo-information systems, artificial intelligence and virtual reality systems, etc.), innovations in the mining industry (nano-processing of oil wells, ultrasonic equipment for enhanced oil recovery) , methods of cleaning and restoring the soil after oil pollution, membrane engineering, etc.), instrument making (laser

technologies, HVM lithography technologies, development of multiprocessor computers with a parallel structure, etc.), biotechnologies (genetic engineering, 3D bioprinting technologies, bionic prostheses, products of deep processing of aquaculture products, biological products for waste disposal, innovative production of feed and food additives, etc.), energy efficiency and energy saving (production of light devices of a new generation, photonics, alternative energy, etc.). Many technologies developed in technology parks in Russia are unique and have no analogues in the world.

To analyze the degree of influence of regions with the highest concentration of technology parks on the level of innovative development of the country, five regions were analyzed, where 40 out of 157 technology parks of Russia are concentrated (Table 2). These regions have a diversified structure of the innovation complex and specialize mainly in information technology, production of composite and nanomaterials, nuclear energy, output for space manufacturing, biomedical technologies, etc. These regions occupy about 2% of the territory of Russia and concentrate 23% of the population while produce more than 38% of innovative goods, works, services.



They account for 39% of the cost of technological innovation and 48% of patents issued for inventions and useful models. They also developed 38% and used 27% of advanced

production technologies. Such a ratio of developed and used advanced technologies indicates a significant creativity of innovation in these regions.

**Table - II: Key innovation performance indicators of regions with the largest number of technology parks**

Key indicators	regions					Average regional level
	Moscow	Moscow region	St. Petersburg	Sverdlovsk region	Republic of Tatarstan	
Technoparks, units	38	19	7	8	6	2
The proportion of innovative goods, works and services in the gross regional product (GRP), %	6,4	10,0	7,1	7,1	20,2	6,0
Volume of innovative goods, works and services, billion dollars	4,2	6,4	5,1	3,4	7,3	0,8
Technological innovation costs, billion dollars	3,2	2,3	1,5	0,8	1,4	0,3
The cost effectiveness of technological innovation	1,2	2,8	3,3	4,6	5,6	2,9
Patents issued for inventions and utility models, units	7816	1994	2537	839	1613	346
Number of created advanced production technologies, units	164	101	130	85	57	17
Number of advanced production technologies in use, units	20649	16819	8933	10662	7648	2824

Compiled by: [15, 16]

One of the leading technology parks in the field of high technologies is the Autonomous Institution (AI) «Technopark-Mordovia» [19]. Its formation began in 2012 when the Data Computations Complex (DCC) was opened. The main areas of specialization there are energy-saving lighting, electronic instrumentation, optoelectronics and fiber optics, the development of nanotechnology and the production of composite materials, information technology. The volume of technology park innovative products increased from \$60 million in 2013 to \$173 million in 2018.

The infrastructure of the Mordovia Technopark is represented by the following main components:

1. Innovatively Manufacturing Complex which includes production, laboratory and storage facilities equipped with modern utility lines and technological facilities. It provides working space for residents and partners in accordance with individual requirements.

2. Center of Energy-Saving Lighting where pilot production of general and special-purpose light sources is based.

3. Center of Experimental Production which has modern offices and production facilities with the possibility with the possibility of placing various experimental and small-scale production.

4. Engineering Center of Fiber Optics which is aimed at developing technologies and experimental manufacturing of special optical fibers with predetermined properties for industrial enterprises of Russia in the field of photonics, as well as training specialists in this research and production direction.

5. Innovation Design Center which provides a closed design cycle: from developing documentation to the creation of a digital prototype layout.

6. Information-Computer Complex which is designed to develop new information technologies and creates optimal conditions for IT companies work.

In order to develop the tertiary sector of the city's economy and improve the population's quality of life the following innovative IT projects are being successfully implemented within the Mordovia Technopark:

1. Creating a unique for Russia DATA-center of TIER IV type which has the highest level of availability and reliability that meets the latest requirements. There data and information about users of electronic services are stored, processed and distributed. The emergence of such a complex has significantly simplified the use of electronic services provided to the population of the city and improved the quality.

2. Adoption of the municipal targeted program «Safe City». The purpose of this program is to develop an automated video surveillance system in the city district of Saransk to reduce crime rates, prevent terrorist acts, promptly respond to possible failures in the traffic system, natural disasters, etc.

3. Creation and development of the Virtual Saransk portal by a small innovative enterprise «Technology of Success». The technologies developed by the company allow creating 3D models of real cities and towns with real virtual tours around them. It will be possible to get brief information on the nearest object as well as take a virtual walk inside it and get more detailed visual and textual information.

#### IV. CONCLUSION

Based on the results of the study we can draw the following conclusions.



1. The level of innovation development of the regions in Russia is largely determined by the degree of production-technological infrastructure development, including technology park structures. They contribute to the transition of most industrial enterprises and organizations of the tertiary sector of the economy to new innovative technologies, the emergence of a significant number of effective small and medium-sized innovative enterprises.

2. Since the mid 2000s the structure of the industrial and technological infrastructure has constantly become more complex, innovative structural divisions have appeared in scientific institutions and higher educational institutions, the dynamics of technology parks and territorial innovation clusters creation have increased. Thus, from 2006 to the present all regional innovation clusters and more than 70% of Russian technology parks have been created.

3. An important factor in stimulating innovative development of regions was the orientation of their technology parks at the domestic market. The growing need for innovative products in the huge and weakly saturated market of the country is an important factor in diversifying the economy and improving the quality of innovative development in Russia. At the same time, the export potential of the Russian innovative products (atomic energy, rocket production, products of the military-industrial complex) is preserved.

4. State financial and institutional and management support preserve the leading role in the creation of technoparks. At the same time the possibilities of public-private partnership are extremely inefficiently used and there are no effective mechanisms for attracting private investment in innovative projects as a result of an unfavorable investment climate in most regions of Russia. To overcome this obstacle the most favorable conditions (financial, tax, rent of premises and equipment, etc.) for conducting innovation activities have been created on the territory of technoparks.

5. In general, the relatively high level of development of the production and technological innovation infrastructure and a significant number of technology parks in Russia do not correspond to the quality and effectiveness of the interaction of their individual components, which is manifested in the low effectiveness of the intellectual property commercialization while executing large innovative projects.

6. The main problem of technopark structures development is low growth rate of new technologies, their rapid obsolescence as a result of a long period of introduction into manufacturing application. It should be noted that in most cases there is a technical discrepancy between the level of the tasks to be solved and the available material and technical equipment of technological processes.

7. Further development of technology parks is associated with the development of effective marketing mechanisms for the commercialization of innovations, improving the quality of education and its focus on innovation issues. The applied focus of scientific research should be accompanied by the diversification of the innovation-technological complex in accordance with the priority directions of technological development of the regions and the country.

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