Igor A. Monakhov[1]

SCIENCE CITIES WITHIN INNOVATIVE ENVIRONMENTS OF RUSSIA AND GREAT BRITAIN: CROSS-COUNTRY COMPARISON

This paper examines the concept and the role of science cities in innovative environments of Russia and the UK. The author provides the statistical data analysis in order to evaluate the performance of Russian and British science cities. In addition, a comparative analysis of the current state and development dynamics of the cities are presented. Similarities and differences between science cities' concepts in Russia and the UK are reviewed in the conclusion of the article.
Keywords: *science city; innovative environment; Russia; UK.*

Ігор А. Монахов

НАУКОВІ МІСТЕЧКА В ІННОВАЦІЙНОМУ СЕРЕДОВИЩІ РОСІЇ І ВЕЛИКОЇ БРИТАНІЇ: МІЖКРАЇНОВЕ ПОРІВНЯННЯ

У статті досліджено поняття і роль наукових містечок в інноваційному середовищі Росії і Великої Британії. На основі статистичних даних проаналізовано досягнуті показники розвитку російських і англійських наукових містечок. Крім того, проведено порівняльний аналіз стану і динаміки розвитку досліджуваних міст. Зроблено висновок про спільні і відмінні риси в концепціях розвитку наукоградів в Росії і Великій Британії.
Ключові слова: *наукове містечко; інноваційне середовище; Росія; Велика Британія.*
Табл. 1. Літ. 16.

Игорь А. Монахов

НАУКОГРАДЫ В ИННОВАЦИОННОЙ СРЕДЕ РОССИИ И ВЕЛИКОБРИТАНИИ: МЕЖСТРАНОВОЕ СРАВНЕНИЕ *

В статье исследованы понятие и роль наукоградов в инновационной среде России и Великобритании. На основе статистических данных проанализированы достигнутые показатели развития российских и английских городов науки. Кроме того, проведен сравнительный анализ состояния и динамики развития исследуемых городов. Сделан вывод о сходствах и различиях в концепциях развития наукоградов в России и Великобритании.
Ключевые слова: *наукоград; инновационная среда; Россия; Великобритания.*

Problem statement. Innovative development of the UK proves to be successful. The country is currently among the global leaders according to the most recent global innovation index published by the Cornell University, the European Institute of Business Administration (INSEAD), and the World Intellectual Property Organization (Cornell University, INSEAD, and WIPO, 2014). According to the Organisation for Economic Cooperation and Development (OECD) the UK economy grew at the fastest rate among G7 countries in 2014 (OECD, 2015). As far as Russian knowledge-based economy is concerned, despite some achievements of the Government of Russia, resulting in the growth of public expenditures on R&D, inno-

[1] Tver State University, Russia.
* Статья выполнена в рамках государственного задания Минобрнауки России высшим учебным заведениям в части проведения научно-методических работ по проекту № 3241 «Аналитическое обеспечение мониторинга результатов деятельности государственных научных центров Российской Федерации и научно-производственного комплекса наукоградов Российской Федерации».

vative development is only picking up the speed. And this has actually made Russian economy more vulnerable to global economic shocks.

Innovative environment at the national level is the one of the key success factors for long-term economic growth. Science cities are the important elements of innovative environment in Russia.

The history of Russian science cities can be traced back to the Soviet period, when the USSR was making enormous efforts to gain advantage in key technologies, win space and nuclear arms race with the USA. This has resulted in the foundation of science cities as territorial units with high concentration of top secret research centers and institutions, whose missions were to conduct fundamental and applied research in such fields as nuclear technology, aerospace, microelectronics etc.

Nowadays science city has the legal status of urban district which has its territory high-technology industries, research centers, higher education institutions etc. Today we witness a new milestone of Russian science cities' development under federal act on the science city's status (7.04.1999, # 70-FZ).

More than 10 years ago some British cities were also labeled by the UK Government as science cities (The Guardian, 2005). Comparing the concepts of science cities in these two countries make it possible to raise an issue on the effectiveness of the concepts mentioned.

Theoretical background. As far as economic theory in this field is concerned one can mention the book by M. Castells and P. Hall (1994) as the first research on science cities phenomenon. The authors viewed the term "science city" as a synonym to technopoles defined as "various deliberate attempts to plan and promote, within one concentrated area, technologically innovative, industrial-related production". From the Oh's point of view, terms "science park", "innovation center", "technopolis", "science city" are interconnected (Oh and Im, 1999). So the science city's phenomenon was considered in the context of spatial organization of innovative activities.

Science city, from the innovative milieu's approach, is a research community, which has some basic features such as communications, science and innovation infrastructure and also a rapid rate of scientific innovations development (Dearing, 1995).

In Russia science cities are treated as special research centers, which had played an important role in the development of all fundamental science in the second half of the XXth century (Agirrechu, 2009) and from the architectural point of view they have been studied in (Frezinskaya, 2009; Lilueva, 2011).

Nevertheless, the abovementioned books lack a theoretical framework and generalizations. So the study of science city's phenomenon is still an actual scientific problem.

Research objective and methodology. The aim of this research is to compare the concepts and the performance of science cities in Russia and in the UK in order to define their peculiarities.

The study is based on Russian and European statistical data. The main data sources are Eurostat database on regional and urban statistics, Office for National Statistics (UK) database on science and technology, Federal State Statistics Service of Russian Federation database on key social and economic indicators of regional development, Ministry of Education and Science of Russian Federation database, which includes the findings from the science cities' monitoring.

In order to get comparable research outcomes based on the statistical data, the relative indicators were used, and others were calculated using purchasing power parities exchange rates.

Key research findings. In Russia science city has its official legal status. According to the federal act as of 1999 science city (or "naukograd" in Russian) of Russian Federation is a municipality, which has the status of urban district with high concentration of scientific and technical capabilities (Federal act, 7.04.1999, # 70-FZ). A set of organizations and companies located on the territory of this administrative unit together forms research-and-production-complex (R&PC), playing a pivotal role in economic and innovative development of a science city. R&PC encompasses only firms and organizations involved in R&D and innovative activity, explorations, testing and training in the priority fields of the development of science, engineering and technology in Russia.

To become a science city a municipality must satisfy the following key requirements:

- the share of employees in R&PC's organizations and firms is no less than 15% of the total employment in municipality;
- at least 50% of all produced in municipality high-tech knowledge-intensive goods must be manufactured in R&PC's companies or the value of R&PC's companies fixed assets engaged in production of high-tech knowledge-intensive goods is no less than 50% of the total value of municipality's companies fixed assets.

When receiving the status of the science city of Russian Federation a municipality enjoys a set of preferences. Some of them are guaranteed by the state including financial support. But the most valuable benefit that a municipality receives from the science city status in Russian Federation is an intangible asset, i.e. the brand that gives a science city and R&PC's companies a competitive advantage.

The status of science city in the UK unlike the one of naukograd in RF isn't supported by national laws. Three science cities were designated by the UK Chancellor of the Exchequer G. Brown in his pre-budget report of December 2004, and the remaining – likewise in 2005 (Perry and May, 2015).

One should mention there are no clearly defined criteria to grant the status a science city in the UK. The main reason why the UK Government has chosen 6 science cities was to stimulate the economic and innovative development of cities and surrounding regions outside the so-called "Golden Triangle" of London, Oxford and Cambridge, which altogether had 45% of the total public sector research funding in 2006 (Webber, 2008).

But the UK Government didn't take any financial commitments to science cities (Gertner and Bossink, 2014). The main goal of science city designation was to give impetus to urban innovative milieu development by stimulating interactions and building partnerships between the key innovative actors – regional development agencies (RDAs), universities, municipal public authorities and business.

So the science city's status in RF and the ones in the UK despite some differences are similar in terms of branding as a intangible asset.

Table 1 summarizes the performance of science cities in the UK and naukograds in RF.

Table 1. **UK and RF science cities: the key social and economic indicators**

No	Indicator	UK Science Cities	RF Science Cities
1.	Total number	6 (Birmingham, Bristol, Manchester, Newcastle, Nottingham and York)	13 (Dubna, Protvino, Pushchino, Troitsk, Chernogolovka, Koltsovo, Zhukovsky, Reutov, Obninsk, Korolev, Fryazino, Michurinsk, Biysk)
2.	Number of host regions	6 (North West, North East, Yorkshire & The Humber, West Midlands, East Midlands, South West)	6[a)] (Moscow capital region, Moscow Oblast, Kaluga Oblast, Novosibirsk Oblast, Tambov Oblast, Altai Krai)
3.	Rank of host regions in the innovation rankings of the EU and Russia, 2014	Innovation Followers[b)]	Innovation Leaders (Moscow capital region, Moscow Oblast, Kaluga Oblast, Novosibirsk Oblast) and Moderate Innovators (Tambov Oblast, Altai Krai)[c)]
Regional Statistics			
4.	Aggregate GDP per capita in the host regions at 2011 PPP, USD	33059	14321
5.	Aggregate regional expenditures on R&D at 2011 PPP, mln USD, total	14151	6075
6.	Gross domestic expenditure on R&D per capita at 2011 PPP, USD	467[d)]	422
7.	Share of the host regions GERD in the total R&D expenditurez in respective countries, 2011, %	28	17
Urban Statistics			
8.	Population as of the 1st January 2012, total, thousand people	2803	1056
9.	Students in higher education, 2011, thousand people	275	31
10.	Number of students per 10,000 inhabitants	981	294
11.	Number of companies in 2011, total	68130	26038[e)]
12.	Number of companies per 10,000 inhabitants	243	272[f)]

Source: author's own calculations; Data from Eurostat, Office for National Statistics (OHS), UNESCO Institute for Statistics, Federal State Statistics Service of the Russian Federation, Ministry of Education and Science of the Russian Federation.

Note:

[a)] After Moscow metropolitan area has enlarged in 2012 Troitsk became the urban district of Moscow.

[b)] Regional Innovation Scoreboard (2014).

[c)] Rating innovative regions of Russia for the purposes of monitoring and control (2014).

[d)] Compared to 628.2 GERD per capita (in USD PPP) in the UK and 245.3 GERD per capita (in USD PPP) in the RF in 2011.

[e)] Except Michurinsk, including public organizations

[f)] Including public organizations.

Table 1 illustrates that the advantage of RF's science cities in the total number "evaporates": if compared to the total population lived in RF's naukograds and the UK's science cities. The latter is almost three times over the total population of RF's

science cities. Similarly, 6 UK's science cities surpass RF's naukograds in absolute and relative students numbers.

So one can conclude that in terms of human resources and human capital that can be managed in a way to increase the value added of companies in science cities, the RF' naukograds are far behind UK's science cities.

Surprisingly, the relative indicator showing the number of companies per 10,000 inhabitants in UK science cities is comparable to the same indicator for Russian naukograds. This suggests that entrepreneurial activities in the UK science cities keep pace with the same activities in Russian.

It is worth noting that science cities have different dissemination within the territory of the UK and RF. For instance, while the density of science cities (science city per host region) in the UK is one, the density of science cities in the RF is twice as much. In addition most science cities of Russian Federation (8 out of 13) are concentrated in Moscow region, and in fact they are the satellite towns of the capital. It is the developed infrastructure and the proximity to the capital city with its high concentration of highly skilled specialists that enable satellite towns meet the abovementioned requirements.

Hence the major difference between state policy approaches with respect to science cities in the UK and RF lies in understanding of their role in innovative environments of the countries under study. The mission of the science cities in the UK is to improve the environment for innovations in order to boost productivity and create the "growth poles" for regional economic development. The main idea that underpins the creation of naukograds in RF is to support the existing national centers of scientific and technological development, help local authorities deal with socioeconomic challenges, neutralize the impact of the 1990s economic crisis and overcome its consequences, including brain drain prevented. In this regard the designation of science cities in RF was somewhat like an emergency tool that helped Russian government maintain human resources in science and technology after a decade of financial and economic turbulence. Thereupon most science cities in RF are located in the regions that according to national innovation rankings belong to innovation leaders in 2014, while in the UK the host regions held the second place according to Regional Innovation Scoreboard prepared by Maastricht Economic and Social Research Institute on Innovation and Technology – MERIT at the same period.

Nevertheless, the implementation of federal policy related to naukograds' sustainable development is far from success, and one of the main challenges, facing Russian science cities, is the lack of public financial support for infrastructure development.

Serious problems of naukograds' development make the Ministry of Education and Science of Russian Federation, which is responsible for monitoring the science cities' performance, the implementation and development of public science policy, to revise the existing federal act on their status in order to change the regulations that influence the public financial support.

Conclusions. The main differences between science cities in Russia and the UK are not only in the approach of public authorities to the very idea of their creation and development, but also in the models of their interaction with other regional and national stakeholders within innovative environment.

At the core of the science city's concept in the UK lies the idea of territorial branding that might be used as its intangible resource, due to which the city gets a competitive advantage, increasing its investment attractiveness at this. Public authorities, initiating the project of science cities' development are pursuing the solutions of several problems:

- to promote innovative activities in local administrative units, involving for this purpose the resources and capabilities of RDAs, universities; municipal authorities and business. In this regard, the concept of science cities in the UK is based on the model of the triple helix, introduced by H. Etzkowitz (2010);
- to minimize the public impact on economic processes at the national and regional levels, promoting public-private partnerships;
- to eliminate the imbalances in economic development of regions;
- to deal with socially important problems by stimulating entrepreneurial activities and the creation of small and medium-sized innovative enterprises.

The UK science cities' practice shows that this approach to the development of science cities is effective in the case if there are well developed innovative infrastructure and innovative capabilities, including human resources for science and technology, innovation policy, innovative culture stimulating creativity among young generation.

However, in those regions and local administrative units where the "critical mass" of these factors is not reached, the science city status is not conducive to the transition to a new level of innovative development.

In Russia, the state has to play a decisive role in the establishment and functioning of science cities. Their status is reinforced by legislation at the federal level. Public authorities, guided by the criteria outlined in the law define how science cities' performance corresponds to the abovementioned criteria and also on the possibility of expanding the list of Russian science cities. Thus, at the heart of the concept of naukograds' development lies the state-oriented approach. The state ensures the budget for the development of social, innovative and engineering infrastructure of science cities.

In contrast to British science cities Russian counterparts are not directly linked to regional economies. To a large extent they are integrated in the innovative environment at the national level. Russian science cities are active participants of various projects launched by Russian government in order to stimulate innovative development: special economic zones, innovative regional clusters, technology platforms etc. The role of universities is more about personnel training for the needs of R&PC's organizations and enterprises than in innovative development as such.

The advantage of Russian concept of science cities' development is in state guarantees and financial commitments ensuring social and economic stability, reducing the risk from economic crises. At the same time, the criteria for assignment of the science city status, laid down in the law, don't cover all the specifics of each individual company, located on the territory of Russian science cities, and peculiarities of urban economy as such, which can lead to the loss of its status in general.

References:

О статусе наукограда Российской Федерации: Федеральный закон от 7.04.1999 № 70-ФЗ // base.garant.ru.

Агирречу А.А. Наукограды России: история формирования и развития. – М.: Моск. ун-т, 2009. – 188 с.

Ицковиц Г. Тройная спираль. Университеты – предприятия – государство. Инновации в действии / Пер. с англ. под ред. А.Ф. Уварова. – Томск: Томск. гос. ун-т систем упр. и радиоэлектроники, 2010. – 238 с.

Лилуева О.В. Архитектурное формирование технопарков на базе наукоградов: Дис... канд. архитектуры: 05.23.21. – Нижний Новгород, 2011. – 185 с.

Рейтинг инновационных регионов для целей мониторинга и управления за 2014 г. // Ассоциация инновационных регионов России // www.i-regions.org.

Фрезинская Н.Р. Пространственная организация технополисов – наукоградов // Academia. Архитектура и строительство.– 2009.– №4. – С. 36–45.

Castells, M., Hal, P. (1994). Technopoles of the World: The Making of 21st Century Industrial Complexes. London; New York: Routledge. 275 p.

Cornell University, INSEAD, and WIPO (2014). The Global Innovation Index 2014: The Human Factor In innovation, Fontainebleau, Ithaca, and Geneva.

Dearing, J.W. (1995). Growing a Japanese science city: communication in scientific research. London; New York: Routledge. 225 p.

Full text: the chancellor's budget speech / The Guardian, 2005 // www.theguardian.com.

Gertner, D., Bossink, B.A.G. (2014). The evolution of science concentrations: The case of Newcastle Science City. In: Science and Public Policy (p. 10).

OECD (2015). Economic Surveys United Kingdom February 2015 Overview // www.oecd.org.

Oh, D.S., Im, Y.-B. (1999). From science city to information city: development of technopolis concept in Korea. In: G.-C. Lim and M.-H. Lee, eds. Global Transformation toward a Sustainable Ciuil Society (pp. 550–565). Seoul: Hand.

Perry, B., May, T. (2015). Context Matters: the English Science Cities and visions for knowledge-based urbanism. In: Julie Tian Miao and et al. eds. Making 21st century knowledge complexes: Technopoles of the world revisited (pp. 105–127). New York, NY: Routledge.

Regional Innovation Scoreboard (2014) // European Commission // ec.europa.eu.

Webber, C. (2008). Innovation, science and the city // The Centre for Cities // www.centreforcities.org.

Стаття надійшла до редакції 30.06.2015.