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Conference Paper

Performance assessment of innovation infrastructure facilities in Russia

54th Congress of the European Regional Science Association: "Regional development & globalisation: Best practices", 26-29 August 2014, St. Petersburg, Russia

Provided in Cooperation with:
European Regional Science Association (ERSA)

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Abstract

Performance assessment of innovation infrastructure facilities might be seen as one of the most topical issues of regional development in Russia. Due to the variety of infrastructure types, it's difficult to select the assessment indicators, for there are no generally accepted and integrated performance assessment measures, based on verifiable data according to the enquiries of the stakeholders.

The article discusses ways to evaluate the efficiency of innovation infrastructure facilities in Russia. We assume, that innovation infrastructure can't be analyzed apart from the national innovation system it. It follows, that innovation infrastructure facilities performance is fully determined by the regional innovation system and its development.

The aim was to find the optimum number of innovation infrastructure facilities, depending on the regions' level of innovative development. The research was based on the Miiris database (gathered by the National monitoring centre for innovation and scientific infrastructure and regional innovation systems), updated and enlarged. The total number of objects analyzed is 1158, situated in 75 regions of the Russian Federation, typically referred to technology&production (the most widespread group), consulting, financial and informational support, human capital (education), sales.

To assess the sufficiency level authors use statistical methods for analyzing the relationship between the level of regional innovative development (defined according to the AIRR rating 2012) and the number of the innovation infrastructure facilities in Russian regions. The analysis has showed that the higher the level of regional innovative development is, the more innovation infrastructure facilities the region has. According to these results, the regions of Russia were divided into four groups: strong innovators (11), average+, average (28), average-, poor innovators (9).

The analysis has also showed the possibility of determining the relevant number of innovative infrastructure facilities for each level of regional innovative development (defined by the regional innovative development index). This number demonstrates nonlinear growth from "poor" to "strong" innovators, that shows the synergy of the innovation potential accumulation in the regional economy.

The important practical output is that building additional innovation infrastructure facilities in regions, described as "poor innovators", average- and in some cases average innovators - is ineffective, for there will be no demand for their services.

In addition, authors propose a set of measures to improve the performance of the innovation infrastructure facilities, including the greater "soft infrastructure" involvement (ICT-facilities, social, professional and organizational networks) as the main way to enhance the private sector role in the regional innovative development.

Keywords: Russian regions, innovation infrastructure, innovation development, effectiveness evaluation

1. The innovation infrastructure system in Russia and its performance assessment

The performance assessment of infrastructure facilities, aimed at providing support for innovations, is considered to be an acute problem for foreign and Russian economists. In practice, it has a number of issues to be taken into account, starting from making up a set of indicators used, to the statistics gathering and processing.

The innovation infrastructure itself is non-homogenous and it's difficult to assess different infrastructure facilities with the same indicators. International consulting Adam Smith International claims that one of the ways to do this is to assess their input and output, where input depends on what infrastructure facilities are evaluated, while the innovative firms' satisfaction with the infrastructure facilities is taken as an output. The companies' satisfaction derives from scale effects, technologies diffusion, improvement of the R&D quality, information asymmetry decrease, global value chains integration (Goncalves, Peuckert, 2011) and other benefits they can get through the active exploitation of the innovation infrastructure facilities.

Second major problem to be coped with is that the innovation infrastructure facilities' performance is to be assessed with different time frames (Tassey, 2008). Short-term effects are the following: the intensification of research cooperation (how many connections have been formed between innovative companies, universities, research agencies, investors etc.), acceleration of the R&D processes, the increased quantity of patents, prototypes, publications. The mid-term effectiveness of the innovation infrastructure results in new products, innovative processes, licenses, as well as formation of strategic alliances, product range diversification and venture capital raising. In the long run the innovation infrastructure facilities might be considered effective, if they result in huge industry-specific externalities, GDP (GRP) growth etc.

In Russia the performance assessment of infrastructure facilities has started to develop recently. As the innovation policy was set as one of the main priorities in late 2000s, with the adoption of the Russian long-term socio-economic development framework 2020 and the Russian innovation development Strategy 2020, the innovation infrastructure facilities were claimed to be one of the tools of promoting innovation development in Russia. The Strategy 2020 states the necessity of innovation infrastructure facilities development, including those created with the help of the government.

Still, only 5 years have passed, so Russia haven't had enough time to build the highly effective innovation infrastructure. With the development of these facilities and the institutional background as a whole, the performance assessment and evaluation has become the topical question nowadays. It is fully realized by the policy makers, proven by the President's speeches and edicts, which declare the will to make progress towards further development of the innovation infrastructure facilities in Russia, including subsidizing the constituent entities of the Russian Federation with the best practices of technoparks, business-incubators and other innovation infrastructure facilities.

A complex approach to the issue is made by the Russian analytical agency «Expert RA» (Expert RA, 2011), who divided the innovation infrastructure facilities into technology&production, personnel[1] etc. and suggested that they are assessed separately.

[1] By personnel infrastructure we mean facilities that create relevant human capital, including those of education.

Similarly, it is possible to focus on certain facilities and objects during the performance assessment, considering certain business-incubators, science parks, technology transfer centres etc For these purposes, innovative business subventions' statistics might be used (collected through questionnaires), lists of residents (for business-incubators and technoparks).

Besides of the low effectiveness of the innovation infrastructure facilities, another problem, rooted in evaluation and monitoring statistics limitations, impairs the prospects of relevant performance assessment in Russia. Actually, huge problems arise during the data gathering and processing. There is no Federal law in the Russian Federation, confirming one integrated definition of innovative activities, that leads to interpretation contradictions while dealing with innovative infrastructure, innovative companies' concepts, etc. Moreover, the system aimed at monitoring and answering the needs of innovative companies does not work in Russia, so a number of different approaches to innovation infrastructure evaluation are used and developed.

Russia is not a typical country for the innovation infrastructure to be evaluated and assessed, not only because of the reasons, stated above. Economically, the constituent entities of the Russian Federation differ greatly from each other, and that should be taken into account. We assert, that the innovation infrastructure is one of the elements of the regional innovation systems in Russia, so its characteristics are fully defined by the region it is situated in. To continue this reasoning, there should be an exact number of innovation infrastructure facilities for every region, which are able to support the innovative companies in the most effective way and fully satisfy the region's needs. The facilities may be then assessed, concerning their inputs and outputs.

2. Evaluation and assessment procedure

The main idea of this article, which we state and then aim to prove, is that the region's level of innovation development and the number of innovation infrastructure facilities in this region are connected.

To evaluate the innovation infrastructure performance in Russia, we started with the analysis of the innovation infrastructure facilities creation in the Russian regions. According to the conceptual and statistical problems, mentioned above, and related articles (I. Dezhina, 2004; Evseev O., 2013; Zelenskaya E., Sokolova E., 2012; Korostyshevskaya E., Nikolaeva T., 2011; Shevelev V., 2011) some facilities may be classified in two or three ways, being financial, engineering etc. at the same time (for example, technopark). More than that, often the real activities of these facilities and their statistical representation do not correspond, for example, many business-incubators serve as business-centers in fact, providing roomage and facilities to trading companies, not innovative neither high-technology companies. This leads to the statistical problems of their measurement, evaluation and assessment.

Considering all mentioned above problems and characteristics of the innovation infrastructure performance, evaluation and assessment in Russia, one of the free-accessed databases were taken and enlarged. The chosen database is named MIIRIS and it was enlarged by the authors with free-access RVC data and Venture Database. It incorporates data for about 1158 infrastructure assets from 75 constituent entities of the Russian Federation, except for the Nenets Autonomous District, the Yamal-Nenets autonomous district, the Republic of Altai, the Republic of Khakassia, the Republic of Ingushetia, the Magadan Region, the Jewish Autonomous Region and the Chukotka Autonomous District.

All facilities were divided into 5 main clusters according to the type of support they are supposed to provide: engineering (technoparks, multiple-access centres, etc.), information and consulting (technology transfer centers, business associations, etc.), financial (venture funds, business-angels etc.), personnel (coaching and training centres etc.), sales infrastructure

facilities. This classification is not naturally indisputable, but makes up one of the approaches to analyze the infrastructure facilities in groups, to evaluate and assess them separately.

The final full database, analyzed in this article, was enlarged with business-catalysers and business-accelerators - of the consulting type and direct investment funds, which have high-technology companies' securities in their dealing portfolio - of the financial type. The share of the engineering facilities has reduced from 48,52% to 38,06% compared to the MIIRIS data base. It's important to mention, that this base is still not full. Neither we managed to eliminate the double registering problem, when some facilities may be referred to different types of infrastructure. However, this database is still the most complete in Russia for innovation infrastructure facilities assessment.

According to the analysis (see figure 1) most of the innovation infrastructure facilities in Russia may be referred to the technology&production type (684 units, which consist 38% of the total number), providing the companies with physical infrastructure and other basic material resources for their innovative activity. For example, business incubators and technical parks, multiple-access centres, high-tech centres may be referred to the technology&production type of the innovation infrastructure facilities. Consulting facilities constitute 22%, financial facilities make up 15% of the total. Other 25% refer to information, personell and sales types of the innovation infrastructure facilities.

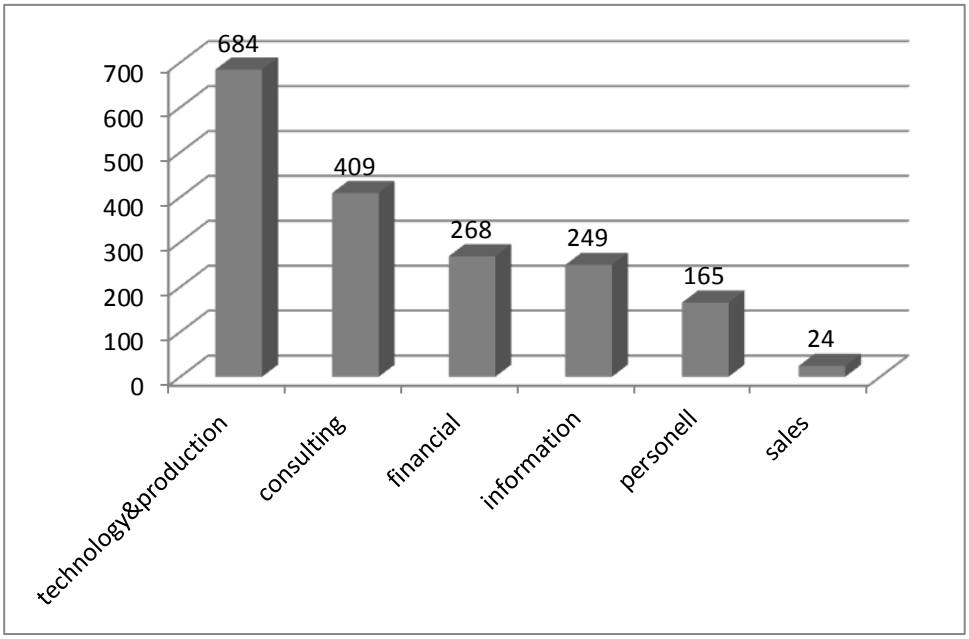

Fig. 1. The innovation infrastructure facilities'types in the analyzed database for Russia

As for regions of the Russian Federation, the types are distributed as following: 51% are located in 11 regions, that are Moscow (19%), St. Petersburg (4%), the Novosibirsk region (4%), the Moscow region (4%), the Sverdlovsk region (3%), the Republic of Tatarstan (3%), the Rostov region (3%), the Voronezh Region (3%), the Tomsk region (3%), the Nizhni Novgorod Region (2%), the Republic of Bashkortostan (2%) (see figure 2). This data was used during the effectiveness evaluation, although without additional calculation it can' be used for innovative infrastructure facilities assessment.

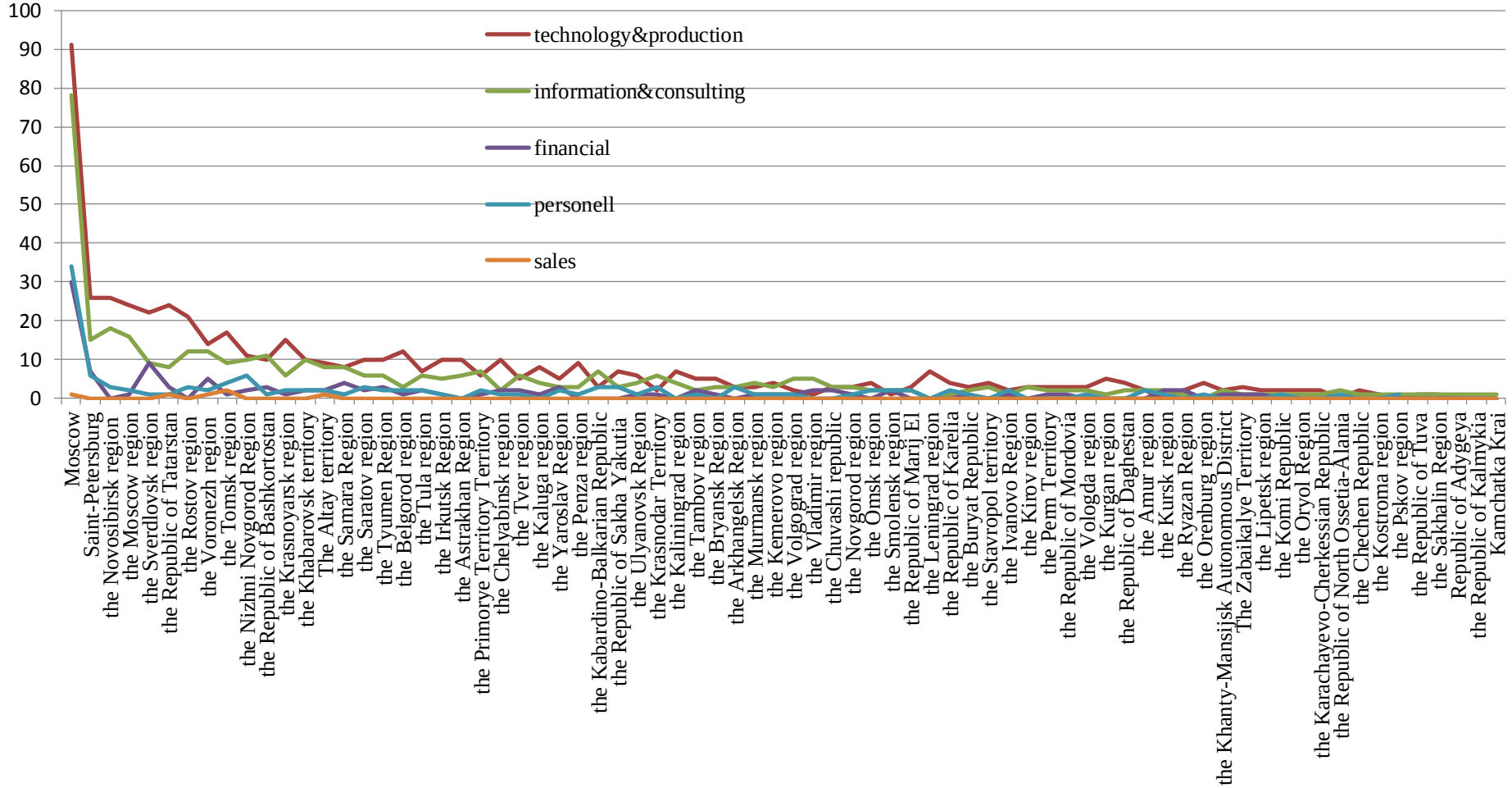

Fig. 2. The innovation infrastructure facilities' distribution in Russia

Aiming to analyze the innovation infrastructure facilities' development and evaluate their performance, we assume that it depends greatly on the general level of innovative development of certain regions the infrastructure facilities are situated in. We use the [2] rating of innovative regions developed by the Association of the Innovations Regions of Russia (AIRR) to range the regions according to their innovation performance. The correlation between the innovation development index of a certain region and the infrastructure facilities' quantity in it is 0.53, that makes partial, not strong correlation (see figure 1).

Figure 3 shows, that mature innovative regions usually tend to have more facilities of the innovation infrastructure. At the same time, regions with lower innovation development index have few or none of such facilities.

[2] The Association of the Innovations Regions of Russia,

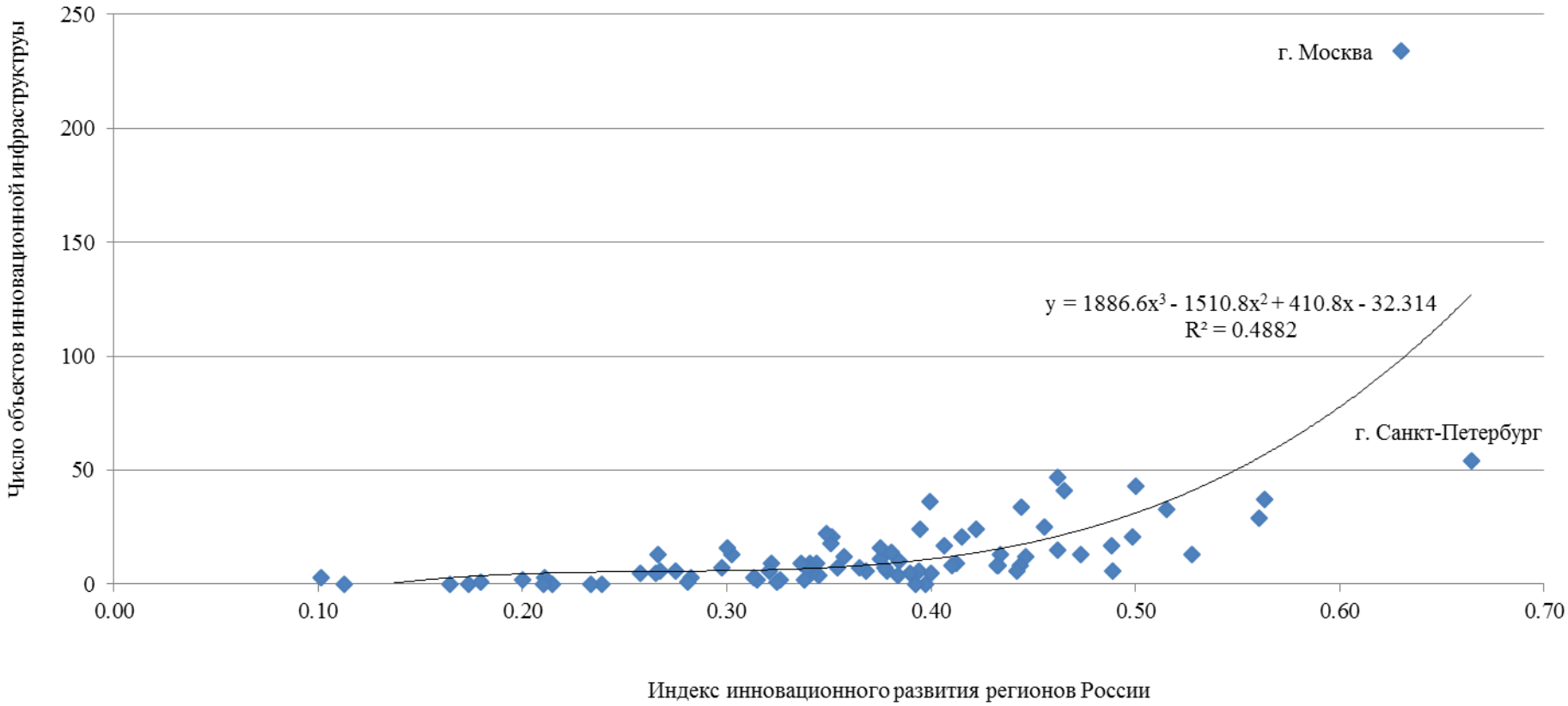

Fig. 3. The Russian regions and their innovative performance, including the levels of innovative development and the number of innovation infrastructure facilities

Table 1

The correlation between the innovation performance of the Russian regions and the number of innovation infrastructure facilities in these regions

Group of regions	The innovation development index (% of the average)	Regions in a group	The average number of the innovation infrastructure facilities in a region
strong innovators	>130%	11	46
average+	110%-130%	17	18
average	90% –110%	28	10
average-	60%- 90%	18	5
poor innovators	<60%	9	1

Table 1 shows, that the regions of Russia were divided into four groups: strong innovators (11), average+, average (28), average-, poor innovators (9). That may be used to prove the positive relation between the region's level of innovation development and the average number of the innovation infrastructure facilities in it.

However the regions' distribution by innovation development levels and by number of innovation infrastructure facilities is nonlinear (see figure 3). Every unit of index advance accounts for increasing number of innovation infrastructure facilities. Above all models, appropriate for the purposes of analyzing this interrelations, we've chosen the third order polynomial, for it's highest validity approximation coefficient (R_2 is about 0.5). This relation is shown in the following equation:

$$y = 1886{,}6\,x3 - 1510{,}8\,x2 + 410{,}8\,x - 32{,}314. \quad (1)$$

According to this equation, it is possible to find the optimum number of innovation infrastructure facilities, depending on the regions' level of innovation development, illustrated by the related index (see table 2). By the relevant number of innovation infrastructure facilities we mean the empirical value of the innovation infrastructure facilities quantity, calculated according to the correlation approximation model of their actual number in the Russian regions and regional innovation development index values (see (1)).

Table 2

The correlation between the innovation performance of the Russian regions and their innovation infrastructure facilities performance

The innovation development index (value)	Relevant number of innovation infrastructure facilities	Examples
0.1	*0*	the Chechen Republic, the Republic of Ingushetia
0.2	*5*	the Republic of Tuva
0.3	*6*	the Astrakhan Region, the Republic of Yakutia
0.4	*11*	the Rostov region, the Ryazan Region
0.5	*31*	the Moscow region, the Samara Region

0.63	*99*	Moscow
0.66	*123*	Saint-Petersburg

Table 2 illustrates the above mentioned relation, giving the virtual values of the regions' innovation development indexes and relevant numbers of innovation infrastructure facilities of the Russian regions. Thus, low innovation development index of a certain region (0.1) indicates, that there are no favourable conditions for innovations in this region, therefore the already developed innovation infrastructure facilities won't be in demand. All in all the higher the level of regional innovative development is, the more innovation infrastructure facilities the region has. If the index value is 0.2, the relevant number of the innovation infrastructure facilities is 5; for the 0.3 index value the number increases to 6. This correlation is nonlinear: the innovation development index interval from 0.3 to 0.4 corresponds to the doubled number of innovation infrastructure facilities, relevant to it (11). The increase of this index to 0.5 results in tripled relevant number of these facilities (31). The leading innovative regions in Russia are Moscow and Saint Petersburg with relevant numbers of innovation infrastructure facilities 123 for Moscow and 99 for Saint-Petersburg, although their innovation development indexes differ by 0.03.

This nonlinear growth of the optimal number of infrastructure facilities, connected with the increase in the region's innovative development index illustrates the synergy, generated in the region. As the region becomes more innovative, the number of innovative actors increases together with the demand on their services and products, so the intensity of the innovation facilities usage in general also increases. The increased number of innovation infrastructure facilities promotes further innovation development of the region.

The figure 3 shows not only the nonlinear correlation between the level of innovation development of the certain region and the number of innovation infrastructure facilities in it, but also the fact, that the same level of regions' innovation development corresponds to different number of infrastructure facilities in different regions. This fact illustrates the diversity in innovation infrastructure exploitation and, consequently, its effectiveness, as well as the peculiarities of the given regions.

These peculiarities go with various models of regional innovation systems. If the regional economy develops through fast commercialization, the innovation infrastructure facilities are widely used and play a very important role in the regional innovation system. If the region is aimed at attracting large high-tech companies, the infrastructure facilities for small and medium enterprises won't be much in demand. In other words, evaluation and assessment of the innovation infrastructure facilities implies the comparison between the quantity of these facilities and their optimal number. During this evaluation it is very important to bear in mind the peculiarities of a certain regional innovation system. Thus, for Saint-Petersburg the relevant number of innovation infrastructure facilities is 123, whether in fact there are only 54 objects in this city. The other way round, Moscow has 234 objects, while the relevant number is 99. These numbers along can't be used in the assessment, because of the unique features these regions have. For example, being a capital city of Russia, Moscow accumulates the financial and intellectual resources, that is why most consulting and financial facilities are situated in Moscow.

It is highly important to mention, that this analysis shows, if the number of innovation infrastructure facilities is close to its optimum, or not; we can't evaluate the effectiveness of these facilities. So it may e recommended to assess the different innovation infrastructure types separately.

3. Implications

This article deals with topical problems of the innovation infrastructure assessment in Russia. These problems become even more acute without the effective monitoring system and lack of representative statistics. Due to the variety of infrastructure types, it's difficult to select the assessment indicators, for there are no generally accepted and integrated performance assessment measures, based on verifiable data according to the enquiries of the stakeholders.

We assume, that innovation infrastructure can't be analyzed apart from the national innovation system. It follows, that innovation infrastructure facilities performance is fully determined by the regional innovation system and its development.

The total number of objects analyzed is 1158, situated in 75 regions of the Russian Federation, typically referred to technology&production (the most widespread group), consulting, financial and informational support, human capital (education) and sales.

The authors managed to evaluate the distribution of the innovation infrastructure facilities in the Russian regions and looked through the effectiveness indicators for certain types of innovation infrastructure. It was proved, that the optimal number of innovation infrastructure facilities in a separate region depends on its level of innovation development. According to the model it is suggested to find the relevant number of innovation infrastructure facilities for each region, based on the AIRR rating and the MIIRIS database, updated and enlarged. The necessity of further micro-economic assessment of a certain facility object through the "input-output" scheme was explained.

To assess the sufficiency level authors use statistical methods for analyzing the relationship between the level of regional innovative development (defined according to the AIRR rating 2012) and the number of the innovation infrastructure facilities in Russian regions. The analysis has showed that the higher the level of regional innovative performance is, the more innovation infrastructure facilities the region has. According to these results, the regions of Russia were divided into four groups: strong innovators (11), average+, average (28), average-, poor innovators (9). The analysis has also showed the possibility of determining the relevant number of innovative infrastructure facilities for each level of regional innovative development (defined by the regional innovative development index). This number demonstrates nonlinear growth from "poor" to "strong" innovators, that shows the synergy of the innovation potential accumulation in the regional economy. The synergetic effect explains the nonlinear increase of the relevant number of innovation infrastructure facilities in a certain region, that goes together with its level of innovation performance.

The important practical output is that building additional innovation infrastructure facilities in regions, described as "poor innovators", average- and in some cases average innovators - is ineffective, for there will be no demand for their services.

The assessment has shown the low innovation infrastructure performance in Russia. We assert, that this is due to the underdevelopment of the "soft" infrastructure in Russia in general, which implies the networking and other ways of close interaction between different innovative actors. Another reason is the fact, that the government plays the leading role in the processes of innovation infrastructure creation, financing and development. We recommend the complex approach to improving the innovation infrastructure performance. It implies giving up the traditional centralized model of governmental development of the innovation infrastructure and increased usage and expansion of the horizontal communications, regional and local initiatives, attraction of all other possible innovative stakeholders, including science tanks, business, research agencies and universities. One of the possible tools used in these processes is the information and communication infrastructure.

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