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S.F. Davidiuk, E.P. Davidiuk, G.I. Dmitriev**THE ANALYSIS OF THE STATE
OF INDUSTRIAL R&D ORGANIZATIONS
IN ST. PETERSBURG****С.Ф. Давидюк, Е.П. Давидюк, Г.И. Дмитриев****АНАЛИЗ СОСТОЯНИЯ ПРОМЫШЛЕННЫХ
НАУЧНО-ИССЛЕДОВАТЕЛЬСКИХ ОРГАНИЗАЦИЙ
В САНКТ-ПЕТЕРБУРГЕ**

The article presents and analyzes the results of the statistical survey of the R&D organizations and several innovation enterprises from the industrial sector of St. Petersburg in 2012.

ANALYSIS. R&D ORGANIZATIONS. INNOVATION STATISTICS. REGION. INDUSTRIAL ENTERPRISES. ST. PETERSBURG.

Содержит и анализирует результаты статистического обследования научных организаций, которые относились к промышленному сектору, а также ряд инновационных предприятий Санкт-Петербурга в 2012 году.

АНАЛИЗ. НАУЧНО-ИССЛЕДОВАТЕЛЬСКИЕ ОРГАНИЗАЦИИ. ИННОВАЦИОННАЯ СТАТИСТИКА. РЕГИОН. ПРОМЫШЛЕННЫЕ ПРЕДПРИЯТИЯ. САНКТ-ПЕТЕРБУРГ.

An analysis and assessment of innovation in any region of the Russian Federation has been always problematic due to the lack of statistical data, and sometimes even due to its complete absence. The political breakup of the Soviet Union in the 1990s has led not only to the collapse of the Soviet economy, but also dissolved the industrial and technological relations established between enterprises earlier.

This survey, conducted by «The North-Western Scientific-Methodical Center» at St. Petersburg State Electrotechnical University «LETI» in 2013, overviews the industrial R&D sector and provides additional material for the analysis of innovation in the regions of the Russian Federation. Moreover, this article allows to assess the scale, the structural characteristics, trends and, to some extent, the effectiveness of the current innovation in St. Petersburg.

The authors collected data from 307 scientific and educational institutions in St. Petersburg. Among them, 156 organizations were industrial companies and institutions which conducted R&D and innovation activities [4]. Furthermore, 94 of these companies and

institutions were privately-owned and the rest – under the government jurisdiction of the Russian Federation. In addition, the survey overviewed 12 innovation – technological centers, which accounted for about a third of all the technology business centers and business incubators located in the city. That is, this survey covered all major types of urban organizations according to their scientific activities and property ownership. Although this survey is based mainly on the data collected from 2012, the authors refer to data collected earlier (during 2010 and 2011) in order to assess trends. It should be noted that this survey covers only the innovation centers from the manufacturing industry mainly.

By the beginning of 2013, the analyzed industrial sector of R&D employed the majority of scientific manpower in the city. That is, 48.7 per cent of all personnel were employed by the organizations surveyed in this article, including 5,700 scientists with PhD degrees; the rest were employed in academic organizations and universities. The cumulative annual funding of the surveyed industrial organizations was US\$2.25b [1]; this funding included own capital

of business organizations – 45.3 per cent and state federal funds – 44.7 per cent; the share of foreign investments and the funds allocated from the city budget was low (3.4 per cent and 1.2 per cent respectively). Traditionally, industrial R&D organizations in the region carried out the government – sponsored projects. These projects dealt with the design and development of dual – use technologies and their manufacturing process on the production facilities of the city.

The main part of all received funding (70.2 per cent) intended to the completion of the government programs in the high – priority areas of science, technology and engineering of the Russian Federation, of which nearly half of the funding was intended for the development of advanced types of military and specialized equipment, 14.9 per cent – for conducting R&D in energy efficiency and energy saving programs, 13.7 per cent – for projects dealing with transportation and aerospace, 9.4 per cent – for environmental management projects and 8.4 per cent – for programs in the IT and telecom sector. Another part of the funding (US\$678.5m) ensured the implementation of a number of targeted federal programs, including 36.8 per cent for various projects in the field of civil marine equipment (these projects will complete by 2016) and nearly as many (33.9 per cent) – for the projects in the field of electrical and electronic engineering (these projects will complete already during 2015), 8.5 per cent – for the R&D projects in the field of security, and 7.6 per cent – for the development of nuclear energy technologies of the next generation. The funding allocated for targeted federal programs focused on nuclear energy and related technologies included short-term funding (until 2015) and long-term funding (until 2020). While evaluating the financial structure of R&D projects and programs, it should be noted that the majority of R&D activities focused on the traditional industrial specialization of St.Petersburg, such as electronics, heavy machinery, energy and shipbuilding.

The effectiveness of R&D activities can be noted in the fact that the surveyed R&D centers published in various international venues and books 41 monographs (every 13th of all published monographs that year), 516 articles and 234 various publications only during 2012.

The government – owned organizations had the largest share in all types of publications (90 per cent of all published monographs, 75 per cent of scientific articles and 96 per cent of textbooks and teaching aids).

The privately-owned institutes contributed mainly by publishing articles – 25 per cent, however only one out of 17 articles was published in international venues. In contrast, government – owned organizations published one out of 8 articles.

At the same time, the number of intellectual property objects created by privately- owned R&D organizations was higher. That is, privately-owned R&D centers registered abroad 21 patents in 2012 (75 per cent of all the patents registered abroad by this group of organizations). In addition, these organizations obtained 1349 patents in Russia (51 per cent), 70 industrial design patents (96 per cent), 464 patents for utility models (68 per cent), 594 registration certificates for databases and topologies of integrated circuits (64 per cent) and 121 know-how certificates (41 per cent). The share of private R&D centers (compared to the total number of patent applications) was 57.7 per cent, and all the patent applications registered abroad (there were 24 of them) were from private R&D centers.

During 2012, private R&D organizations received US\$3.54m from sales of their intellectual property (97 per cent of sales of intellectual property among all surveyed institutions). Besides, private R&D organizations received US\$1.6m (87.9 per cent) from production and sales during the same year, including sales of intellectual property US\$0.52m (86.2 per cent). These organizations earned US\$0.49m (96 per cent, i. e. almost the entire amount of sales abroad) [4, 11].

The analysis of trends and dynamics of these indicators is currently difficult; as such analysis requires a deep systematization and existence of a comparable range of surveyed enterprises and organizations. In addition, such kind of data and analysis is reliable and meaningful only regarding patents and patent applications confirmed by existing registration documents. The most general estimate of the dynamics of indicators of the analyzed R&D sector is unstable. However, it should be noted that these performance



characteristics are significantly inferior than the ones of major R&D centers of leading industrialized countries.

In 2011, the sales volume of innovation products and services in St. Petersburg was equal to US\$5.2b, amounting to only 9 per cent of the total sales across all categories of products and services, which is obviously lower than the scientific and technical potential of the city [2, pp. 30–33]. In 2012 only the academic R&D organizations (which were covered in the referenced survey), manufactured products and services for US\$1.8b, of which at least one third were related to innovation products (34.4 per cent). These sales volumes are lower than the ones in leading industrialized countries. While the typical problem is the insufficient adoption of results of R&D activities, the interaction between science and industry in the city needs to be improved. The state program titled «the Science. Industry, Innovations in St. Petersburg during 2012–2015 years», funded US\$153.75m for the whole duration, aims to solve some of these problems.

It is a publicly known fact that St. Petersburg as well as the whole country need to implement active measures to stimulate small business. This is particularly important in case of small innovation business, as the results of this survey confirm the economic impact of innovation on business in general. Thus, the average number of patents, certificates and know-how applications registered by the companies – residents is 20.7 items, while the same indicator is only 6.3 items among all surveyed organizations. This suggests that certain most active and successful researchers are trying to commercialize the results of R&D activities in technology centers, business incubators and innovation centers. According to the survey in 2012, it resulted in the creation of 272 research spin-off companies, with about a fifth of these companies being started by young scientists and specialists. The spin-off companies hosted by business incubators and technology centers were the most initiative in attracting different forms of funding to finance their activities. Our analysis shows that the funding received by the research spin-off companies (resulted from academia) was mainly from non-governmental sources (91 per cent), while corporate (i. e. industry) spin-offs received

the majority of their funding from various federal target programs (74 per cent).

The analysis of general conditions of business development in the largest cities of the Russian Federation, conducted with the assistance of the World Bank in 2012, showed that St. Petersburg was ranked only the 27th out of 30 surveyed cities in the Russian Federation [3, p. 2]. This, undoubtedly, has a negative effect on the development of innovative business opportunities [10, 13, 17, 21].

The Venture Capital Assistance Fund has recently made certain steps to change this situation and is contributing to the financing of the development of small innovative enterprises in R&D sphere of St. Petersburg. In addition, according to the Public Council for Small Business Development affiliated with the administration of St. Petersburg, one of the possible ways to revitalize innovation activity of small business could be the creation of an organization which will act like the official representative of the Federal Fund for Supporting Small Innovative R&D Enterprises on the basis of the technology center «Polytechnic». The Fund and St. Petersburg administration committee for Science and Higher Education have already signed an agreement on the creation of the representative. This action is vital as the Fund is currently financing a large part of the surveyed R&D organizations (US\$0.196m) and the number of research projects completed in 2012, the results of which are ready for use equals 5285. Taking in account the ambiguity and subjectivity of the latter indicator, the gap is too large; a significant part of the city's science potential has not yet been utilized fully.

The city, particularly, needs innovation in the following five industrial areas: automotive, food processing, mechanical engineering and electronics, energy equipment manufacturing, and shipbuilding. The last three areas urgently require high-priority financial and organizational support from both the federal and the city governments. This is especially important since the government funding allocated for different levels of regional R&D industrial sector amounts to about half of all funding which is vitally important for the whole industry.

Traditionally, the success of innovation depends on how effective is the interaction and

the relationship between the R&D organizations and the industry. In addition, innovation of the industrial sector of St. Petersburg is largely determined by the conditions and development perspectives of the largest industrial enterprises of the city. Although the latter do continue to make profits, they are not in their best shape [13–15].

During the period of reforms, the amount of state-funded projects for typical products (energy equipment, ships, optical and wireless hardware) has decreased significantly; the depreciation and obsolescence of infrastructure on many factory sites reached 75–80 per cent; the factories experience lack of qualified personnel. Despite this, about a third of all 700 large and medium-sized enterprises in the city can be attributed as innovation enterprises, and their production processes are often based on the technologies and equipment imported from abroad.

Several large industrial associations either have ceased to exist (e.g. the «Sverdlov Factory» or the «Turbine Blades factory»), or have partially changed their product lines (like the «Izhorskij plant» and the «Kirov plant») [16].

Former highly specialized enterprises are overcoming economic difficulties and struggling with restructuring their product lines. For example, the Kirov plant which produced only tractors previously, started to manufacture subway carriages, trams and double-decker trains from 2013; manufacturing takes place in the Kirov-Skoda plant. The rolling stock has been designed by foreign specialists from the Skoda-Transportation while the majority of assembly lines and production processes used imported ready-made components. And only by the end of 2014, the management was tasked to achieve 60 per cent localization level of the local production. Although the success of this particular example of new products development can not be considered as an achievement of Russian science, it allows the plant to count on possible large state-sponsored orders in future. Another company, «The Kirov-Energomash» (the subsidiary of «the Kirov plant»), is going to revive its turbine production as it has received an order for the production of a steam turbine for the new nuclear icebreaker which is being built at the Baltic Shipyard. It is planning to utilize its proprietary technology already developed by

Russian specialists. The implementation of this large order (US\$61.3m) has already begun, although some legal issues need to be settled still [16, pp. 50–51].

The lack of large-scale state orders is one of the major problem that the plants are facing in the region. Although they may potentially acquire government orders by participating in state tenders, however this requires them either to change their production (partially or entirely) or to install and utilize new technologies and, therefore, conduct expensive upgrades of their production equipment. Pressed to survive in absence of adequate funding, many plants were forced to lease their production areas; often by converting them into office spaces for independent small and medium-sized enterprises. As large plants occupy considerable space in the urban areas where prices often reach as high as US\$250 per square meter, these plants have a relatively low but steady income. Obviously, such economic activity does not stimulate innovation and generates low income for the city budget. It might be economically profitable to demolish these factories in order to use the site for residential buildings, shopping centers and other commercial real estate. Furthermore, is not always profitable for investors to rent existing production lines and areas on city's old factories when new smaller factories are created. As a result, Siemens is currently building new factory buildings for their production and maintenance lines of 172 and 295 MW gas turbines in Gorelovo community in St. Petersburg suburbs. «The Siemens factory» is expected to reach its full capacity production by 2018. However, by the end of 2014 only, the city lost about US\$377m in potential investments, a possibility to organize a state-of-the-art high-technology production and to improve the situation at the labor market of highly-skilled professionals. To attract even more investors to the region, the government offers a number of tax exemptions: a zero tax rate for commercial real estate and a low income tax rate (13.5 per cent vs. usual 24.5 per cent) during the investment payback period [12, 15, p. 6].

Thus, the regional financial policy and active lobbying of the city's interests are closely related with the city's innovation climate and the ability to upgrade and rebuild its industrial infrastructure. For the sake of development of



the region, the city administration needs to take into account that currently city's industrial enterprises are focused too much on manufacturing large-scale machinery. Hence, for objective reasons, these enterprises have a relatively low level of R&D and weakly stimulate innovative activity. In contrast, the most modern high-technology manufacturing factories are located in urban areas; these are mainly medium and small-scale factories which are characterized by flexible management, focus on manufacturing high-technology products with a low consumption of raw materials and energy, and involvement of highly-skilled labor.

The industrial policy of the city should contain clear aims to support only those machinery-manufacturing enterprises which are capable of competing in domestic and foreign markets. Although city's multiple high-technology factories fall into this group, they require investments which exceed the financial capabilities of even largest enterprises. It is a well-known fact that, in order to attract the desired investments, a business needs to provide not only personnel and manufacturing capacities, but also to ensure the efficiency of the manufacturing process, to provide utilities and logistics, and to make sure that the project documentation is approved in a timely manner. Similar requirements are applied effectively in the developing regions of the Russian Federation, e. g. in Tatarstan [18, 20].

The development of shipbuilding as well as heavy machinery industries in the city remains problematic according to experts. M. Remizov, the president of the expert council affiliated with the administration of the Russian Federation, argues that the long-term strategy of the United Shipbuilding Corporation remains insufficiently defined which negatively affects its product line and innovative orientation. The State Scientific Center «Krylovskiy» – the leading research center in the shipbuilding industry, as well as all three St. Petersburg's shipyards which belong to the corporation (i. e. «The Admiralty Shipyards», «The Baltic Shipyard» and «The Severnaya Shipyard») still determine the production specialization in the industry. Future orders depend on this specialization. These factories and shipyard need a serious modernization of the entire

manufacturing infrastructure which will take into account the achievements of the technical progress and new logistics solutions in the global shipbuilding in the recent years. The time and financial costs required for such a modernization could be even higher than building a new manufacturing enterprise in St. Petersburg suburbs. Major investments in the modernization of urban shipyards are certainly justified. Without these investments, the state program «Shipbuilding Development in 2013–2030» (US\$7.967b) which allocates only US\$824m (8 per cent) for construction and modernization of shipbuilding enterprises will only increase the traditional gap between science and industry and will waste the efforts [16, pp. 31–32].

It should be noted that the foreign car assembly factories located in the city, despite their high-technology manufacturing processes, are far from solving the domestic innovation problems. With the localization level of less than 50 per cent they do not plan to increase the usage of domestic products in perspective. These factories provide employment for a relatively small proportion of a local skilled labor and their taxes correspond only to a small fraction of the city budget, thus minimizing their involvement in the innovative development of the region.

To sum up, St. Petersburg remains the major R&D center in the country, a concrete plan of industrial and innovation development in the long run urgently needs to be created to improve the city's innovation activity. So far, the published version of the state program «The strategy of socio-economic development of St. Petersburg until 2030» [19] raises more questions than gives answers regarding the regional innovation policy. Therefore, in addition to the above-mentioned recommendations, the authors suggest organizational measures which are not limited to direct financing only. These measures should include: the creation of a public system of regional incentives and tax exemptions and a simplification of the bureaucratic procedures required for registering an innovation business. Furthermore, the regional administration should monitor and analyze the innovation situation in the city, in order to be able to coordinate and plan activities of all the participants of the innovation process in the city.

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