

Improving the mechanism for nanoindustry development as a factor in ensuring the competitiveness of Russian regions

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Abstract – This article substantiates the need for correcting the blocks of an established economic mechanism for the development of national nanotechnology industry (nanoindustry) in the conditions of emerging new technological and corresponding to it social-economic mode, economic sanctions imposed on Russia, which facilitates the realization of innovative potential of the regions and boosting their competitiveness. The authors have described the current conditions of Russian nanoindustry, identified areas and appropriate correction measures of improving the mechanism for nanoindustry development in the context of an unfavourable environment.

Keywords — nanoindustry, sanctions, economic mechanism of nanoindustry, competitiveness

I. INTRODUCTION

The results of the first decade of created nanoindustry in Russia that has been affected by a contradictory influence of a number of institutional, organizational, information, technological and financial factors, including the imposition of external political and economic sanctions as well as the unresolved internal problems of national nanoindustry determines the need to adapt its development strategy to the modern conditions of unfavourable community environment.

However, it is necessary to mention the fact that in the modern conditions there was no strategy as such of nanoindustry development in the RF at the national and, moreover, at the regional levels.

It is rightful to point out the absence of such a strategic document as most pressing issues of modern nanoindustry development.

In fact, the period of validity of the nanoindustry development programme in the Russian Federation expired as early as 2015; however, a new document of strategic nature in this field has not been adopted yet. Currently the instruments

of this programme implementation are the projects within federal target programmes (FTP), programmes of the Ministries and Departments, organisations' thematic work plans and the projects of science foundations (RFBR, RSCF).

At the same time, it is obvious that the ways and mechanisms ensuring the development of nanoindustry as a field, which is strategically important to strengthen international scientific, technical-technological and economic competitiveness in Russia in view of the growing global competition, requires a systematic scientific basis and has to be defined in an appropriate document that has public status.

Thus, it is necessary to determine relevant areas of improving the strategy of nanoindustry development in the Russian Federation in its general, broader sense.

II. MATERIALS AND METHODS

The complete study implies the use of a statistical method, which determines the credibility and reliability of the results obtained.

Data collected from JSC RUSNANO, the Fund for Infrastructure and Educational Programs (FIOP), expert estimates and researchers' calculations published in the press as well as legal normative documents on the federal and regional levels served as the empirical basis of the research.

III. RESULTS AND DISCUSSION

The development of modern foreign and Russian approaches to the study of economic mechanisms and the strategic management of economic systems has enabled to define the mechanism for the strategic development of nanoindustry in the Russian Federation as based on the complex analysis of modern state and estimated development

way of its progressive transformation by means of using by the entities of different levels of national community system of special methods, instruments, sources and communication channels, factors and capitals.

The purpose of the mechanism in question is tackling contradictions that arise in the context of unfavourable economic environment faced by nanoindustry entities in the Russian Federation in economic activities in the field of production and market promotion of nanotechnology, nanoindustry goods and services as well as their productive use.

The terms and status of the strategy depend on its scale, which implies identifying its short-term, mid-term and long-term objectives as well as providing the implementation of the plans containing specific parameters and solutions, including those regarding rationale for the strategy and pinpointing the areas of its correction in case of its deviation from the required trajectory of its accomplishment.

The appropriateness of these corrective measures can be ensured if they are based on the results of decomposing the implementation mechanism for the Russian nanoindustry development strategy into its basic substantive blocks (entities, their objectives, objects of liaison, methods and instruments, etc.) undertaken by Oleg V. Inshakov, Honoured Scientist of the Russian Federation, in his study of the problem under consideration in 2009 [1, p. 74-83].

Theoretical modeling of the implementation mechanism for the nanoindustry development strategy in the Russian Federation has allowed to determine general areas of remodeling basic elements of the above mentioned blocks.

Block: entities; purposes; objects of liaison.

Direction 1: the correction of the composition of entities of the state investment policy in the sphere of nanoindustry

Conducting sanction policy against the Russian Federation in the financial sphere which has led to the rejection by the European Bank for Reconstruction and Development (EBRD) to participate in setting up the fund's "private equity" with JSC RUSNANO, the reduction of the volume of foreign investment and the loans for Russian companies and banking structures, freezing or refusal on the part of foreign partners from implementing nanotechnology projects, has become a significant factor which made it necessary to rationalize subject-object structure and resource base of the interaction mechanism of the nanoindustry entities in the RF. It was reflected in the reorientation of RUSNANO investment strategy into the international capital markets in the Asian-Pacific region and the Middle East [2].

However, in spite of conducting active negotiations in 2014-2017 with prospective state and private investors from China, Malaysia, Singapore, the Republic of Korea, Japan, United Arab Emirates only two out of six investment funds (with attracted investments at the size of 48 billion rubles accrued) created over that period with RUSNANO involvement have foreign co-investors [3].

Besides, RUSNANO has created a pool funds, which includes a few "potential" funds: Russian-Malaysian Fund "Rusnano Asia Nanotechnology Investment Platform", Russian-Iran Fund, Russian-Chinese Innovation Private Equity Fund, Singapore Venture Capital Fund and Russian-Arabic Private Equity Fund. All of them are at different formation stages, but the dates of commencing operations have not been announced yet.

Thus, in the process of establishing new investment funds it is useful to emphasize a fuller realization of the potential of the interaction between the state institute of nanoindustry development and strategic national investors whose innovative development is in question for the development strategy of such funds. The participation of major Russian production companies in the formation and functioning of these funds will be conducive to the concentration of investments on the development of the most demanded technologies, their accelerated industrial application when producing knowledge-intensive, import-substituting and export-oriented manufactured nanoindustry goods and services with a high share of added value.

Direction 2: eliminating the asymmetry of the allocation of the entities of innovative nanoindustry infrastructure being created in the Russian Federation's regions as well as the promotion infrastructure of nanoindustry products in Russia; overcoming asynchronous involvement of the Russian regions in the processes of nanoindustrialization

In 2017 the production of goods and services was carried out by nanoindustry enterprises in 59 out of 85 regions in Russia. Their allocation is also characterized by an extreme unevenness in certain regional economic systems. For instance, in Moscow 128 nanoindustry enterprises are based, in the Republic of Tatarstan their number is 85, 43 in St. Petersburg, in the Novosibirsk and Moscow areas there are 24 enterprises in each, 21 in the Sverdlovsk area, 13 in Perm Territory, in the Tomsk, Vladimir and Samara areas there are 12, 11 and 10 enterprises respectively [4].

Created with the participation of FIOP, 15 nanotechnology centres, 9 technological engineering companies and 4 technology transfer centres are based in 10 Russian regions.

In the economic space of only a few constituent entities of the Russian Federation there is an apparent concentration of realizable nanotechnology projects: only 4 constituent entities are allocated slightly over half (48 out of 95 – 50.5%) of such projects; 25.3% of the projected are being implemented in Moscow, 10.5% in the Moscow area, 8.4% in St. Petersburg, 6.3% in Novosibirsk [4].

Asynchronic participation of the Russian regions in the nanoindustrialization processes is due to the differentiation of their innovative and industrial potentials, the regional asymmetry of the development of the main nanoindustry structure and infrastructure, the results of its creation and functioning achieved by the regions.

However, the reproduction and preservation of such a differentiated participation of Russia's regions in the processes of innovative modernization of the national economy may

become a factor of aggravating regional disproportions and curbing the transition to the VIth technological mode as early as in the mid-term.

One of the main tasks in the sphere of the nanoindustry infrastructure development is the growth of a non-public sector: the development of business incubators, technology parks and intellectual centres, leasing and commercial structures. In order to stimulate the innovative activities of nanoindustry companies the role of business incubators is increasing to support the funding of the projects implemented by them.

Currently there are 72 incubation programmes operating in 42 Russian regions, while most programmes are located in the Volga and Central federal regions. Meanwhile many programmes operate in such innovative centres in the country as Moscow, St. Petersburg, Kazan and Samara.

Russian programmes function with such sources of revenue as sponsorship by major companies and collection of payment for the use of services, thus decreasing their dependence from the governmental subsidies. On the other hand, the share of service fees (~ 54%) in the structure of funding sources of incubators and accelerators in Russia exceeds significantly a rate in European countries (48%) and the rest of the world (45%), which can hardly be regarded as a positive moment for aspiring companies' development. (Figure 1).

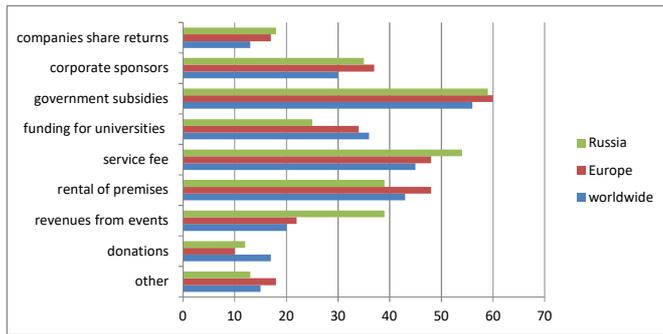


Figure 1. Sources of funding incubators and accelerators.

Besides, the average budget of incubators in the world exceeds almost twice that of the Russian programmes. Many Russian programmes adjust their proposals to technological startups. However, each of 72 Russian programmes over the last 5 years has helped create on average 309 working places in startups whereas in European incubators this figure accounts for 342 working places, and the world average is 493 [5].

The aggregate level of attracted investments over 2012-2016 in Russia from venture capital funds, business incubators, corporations and the state accounted for USD 5 million, which is 5.4 times less that of European countries and 4.6 less than the rest of the world [5].

Venture capital availability provides a fertile ground for the increase in the number of patents in the field of nanotechnology.

The analysis of dynamics of nanotechnology patents granted by European Patent Office (EPO) over 2013-2018 [6] has shown that the leading positions were occupied by the USA, Germany, France, Japan and South Korea (see table I).

TABLE I. NANOTECHNOLOGY PATENTS GRANTED BY EUROPEAN PATENT OFFICE IN 2013-2018

Rank	Country	2013	2014	2015	2016	2017	2018
1	USA	350	361	421	577	669	856
2	Germany	243	206	229	289	354	355
3	France	145	140	152	208	236	288
4	Japan	134	141	131	188	265	318
5	South Korea	55	73	52	105	166	251
6	UK	38	45	45	81	89	114
7	Switzerland	47	63	48	75	95	103
8	Netherlands	45	38	43	71	69	89
9	China	16	14	28	59	64	90
10	Italy	37	29	47	49	61	56
...
57	Russia	0	4	3	6	4	8
	World	1,255	1,289	1,415	2,006	2,386	2,908

In 2018 compared to 2013, the number of patents granted in these countries had more than doubled. At the same time, Russia was in 57th place in this rating.

As shown in table II, between 2013 and 2017 there was an unstable but positive in general dynamics of patent granting by UPSTO to the countries in question. The leaders in that regard were the USA, South Korea, Japan and Taiwan [7].

TABLE II. NANOTECHNOLOGY PATENTS GRANTED BY THE UNITED STATES PATENT AND TRADEMARK OFFICE (USPTO) IN 2013-2018

Rank	Country	2013	2014	2015	2016	2017	2018
1	USA	3615	4414	4365	4316	4725	4343
2	South Korea	501	667	839	914	1044	887
3	Japan	587	889	902	819	733	640
4	Taiwan	425	551	500	514	490	427
5	China	270	357	393	416	524	520
6	Germany	248	496	307	301	378	309
7	France	176	347	242	210	235	236
8	Netherlands	115	155	156	136	122	101
9	UK	87	145	109	123	144	133
10	Canada	85	127	109	106	119	115
...
37	Russia	4	11	8	12	7	1
	World	6,354	8,681	8,588	8,484	9,145	8,493

However, in 2018 compared to 2017 there was a decrease in the number of patents granted by the United States Patent and Trademark Office with regard to all the countries considered over 1.2 times less than in 2017. Over the whole

period in question in 2018 there was the minimum number of USPTO patents registered with regard to Russia.

Thus, in the constituent entities of the Russian Federation, a need is observed for business incubators with various functional designation and a set of services oriented to the launch and support of those companies at their early stages and industrial-technological focus.

Block: methods; instruments; sources of means to achieve goals.

Direction 1: improving the organizational and information methods of implementing nanoindustry development strategy

The impact of economic and technological sanctions, which complicate the development of Russian nanoindustry in the catch-up format in relation to the leaders of nanotechnology race (the USA, the EU, Japan) as a natural phenomenon of a later involvement of the Russian Federation in the processes of active elaboration, commercialization and manufacturing applications of nanotechnologies, updates the regulating mechanism of the domestic market for nanoindustry products in the aspects of its protection and regulation, the stimulation of demand and support for promoting nanoindustry goods and services to foreign markets in an increasingly competitive environment towards the global leadership in the technology sphere.

To increase the efficiency of protectionist measures concerning the national producers and the domestic market for nanoindustry goods and services, it is useful, first of all, to coordinate the actions on the permanent basis of the monitoring system of the situation on the Russian market for nanoindustry products, including in the Russia Federation's regions, with the purpose of identifying emerging external threats to national producers and a rapid response to those at a macro and meso level. The completion of the formation of an updated list of these products and ensuring prompt consequent changes in commodity nomenclature of foreign economic activity (CN FEA) will be conducive to obtain the results from temporary introduction or increase in the rate of import customs tariff, in case of acknowledging the fact of the above threat. This work is being carried out; however, the institutional reflection of nanoindustry development processes in CN FEA and EAEU are implemented with delay.

Meanwhile one should bear in mind that Russia's membership in WTO restricts its opportunities to use the instruments of tariff and non-tariff regulations, the application of traditional anti-dumping, protective and compensational measures to regulate the turnover of nanoindustry goods. Additional restrictions in this sphere are attributable to the sanctions context of economic and technological relations of Russian nanoindustry enterprises with overseas counterparties. One cannot rule out the probability of import quota or a complete/partial ban from the import of nanoindustry products of a certain kind, a certain company or from a certain country, although stipulated in the WTO Agreement on Safeguards [8], may cause an asymmetrical response regarding Russian export goods.

Therefore more realistically achievable and feasible for the purposes of protecting national producers and the domestic market for nanoindustry products from its large-scale import from abroad would be the use of the system of national standards and mandatory pre-market certification whose application is regulated by the WTO Technical Barriers to Trade (TBT) Agreement [9]. In this connection, there is an increasing significance in coordinating actions to elaborate, correct and establish the national standards and mandatory pre-market certification, which are necessary to carry out in collaboration with major enterprises and organisations – the producers of nanoindustry goods and services in Russia.

Direction 2: improving the institutional method of the mechanism for implementing nanoindustry development strategy in the Russian Federation.

The corrective measures of this direction include:

1. The elaboration of legal and regulatory documents aimed at protecting investors operating in unfavourable environment; improving the system of guarantees for prospective investors in the production-innovative sphere of nanoindustry.
2. Arranging economic and legal interaction of innovative centres as well as innovative funds to promote nanoindustry goods and services in the domestic market.
3. The adoption by the constituent entities of the Russian Federation of advanced standards securing well-grounded requirements and competitive advantages of nanoindustry goods.
4. Securing the balance between the Russian standards and foreign ones (at the level of 80-85%) to increase the market activities of Russian nanoindustry companies in the world markets.
5. The creation of regulatory framework for the realization of the networked learning with the inclusion in it of regional institutions of higher education and the legitimization of an online segment of higher education aimed at modernizing the system of training and re-training of professional specialists for nanoindustry organizations and enterprises.

IV. CONCLUSION

Understanding the current state of the Russian nanoindustry in unstable environment enables to determine a general dimension of changes in the substantive blocks of mechanism for implementing nanoindustry development strategy:

1. Rationalization of the subject-object structure and resource base of the mechanism of interaction between RF's nanoindustry entities, taking into consideration a new geopolitical situation, modern peculiarities of external and internal economic conditions.

Corrective measures:

- The tactical reorientation of the search vector concerning foreign investors to create joint investment and venture funds along with the state institutions of nanoindustry development (RUSNANO, RVC etc.), the implementation of nanotechnology projects in the direction of Eurasia and Asia (EAEU, SCO and BRICS countries); access to international capital markets in APR and the Middle East to level the negative effects of the sanctions policy against the Russian Federation in financial sphere.

- The objective assessment of the potential and the prospects of foreign investors' participation in establishing investment funds and the realization of nanotechnology projects by JSC RUSNANO including those within nanotechnology clusters.

- Designing regional programmes on nanoindustrialization and their incorporation in the strategies of social-economic development of RF regions.

- The formation in the Russian regions of the networks of business incubators of different functional designation and with a different range of services that are oriented to the launch and maintenance of regional nanoindustry companies at their early stage and production and technological aspects of the work.

2. The correction of a system of the interconnected organizational, institutional methods and related tools of the mechanism for the strategic development of Russian nanoindustry.

Corrective measures:

- The completion of the formation of an updated list of nanoindustry products and ensuring prompt consequent changes in commodity nomenclature of foreign economic activity (CN FEA).

- The establishment of a permanently active monitoring system of the situation in the Russian market for nanoindustry goods to identify emerging external threats for national producers and a rapid response to them at the macro and meso levels.

- The use of the system of national standards and mandatory pre-market certification whose application is regulated by the WTO Technical Barriers to Trade Agreement as a protection measure for the domestic market for nanoindustry goods.

- The coordination of actions to develop, correct and establish the national standards and mandatory pre-market

certification jointly with major enterprises and organizations, i.e. the producers of nanoindustry goods and services in Russia.

- Drafting legal normative documents aimed at protecting the investors who operate in today's unfavourable conditions.

- Securing a balance between the Russian and foreign standards to increase the market activity of Russian nanoindustry companies in the world markets.

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