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Russian Nanotechnology Industry Development: The Impact of External Political and Economic Sanctions

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Abstract:

The article analyzes the results of nanotechnology industry (nanoindustry) development in Russia, and the negative and positive effects of sanctions imposed by the US, the EU and other countries in 2014-2015. The authors substantiate the need to identify new vectors and forms of government and private companies' international cooperation in research, innovation and production applying nanotechnology. An assessment of the Russian government policy of import substitution of materials and equipment for domestic nanotechnology industry in terms of their relevance is carried out. The necessity to increase financial and social base of nanoindustry development, reliability and diversity of investment sources, activation of institutes and mechanisms of nanoindustry enterprises self-regulation are justified. The expediency of finding additional resources and forms of sanctions countering through the institutes and mechanisms of integration unions (EAEU, SCO, etc.) is pointed out. The presence of import substitution limits in modern Russian nanoindustry is shown, which sets the task to define its rational boundaries in the future.

Key Words*: nanotechnology industry, sanctions, import substitution, strategy of nano-industrialization, institutes of nanotechnology industry.*

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1. Introduction

One can hardly agree with those who see only positive effect (increased motivation, government stimulus, growth in domestic demand and sales, etc.) of the sanctions against Russia. Public opinion is focused on domestic issues and underestimates the importance of the external problems arising. But global assessments of Russian nanotechnology industry (nanoindustry) current state are not overestimated or contrived. It should be mentioned that nanoindustry is interpreted in this study as an over-sectoral form of economy development based on the scaled organizing the standardized mass production of the new generation of goods and services, manufactured with the use of general purpose nanotechnology and promoted at all global economic system structure levels. Development of this new global technological mode is an extremely complicated process, which increases competition, forcing the participants of the process to establish barriers and impose sanctions, change their strategic orientations and priorities, formats and mechanisms of their doings associated with enormous risks not only for Russia but also for all of its partners in investments, projects and collaborations in the future development of the nanoindustry.

External sanctions have already created two high barriers to nano-industrialization in the Russian Federation: technological and financial ones. Technological barrier limits the delivery of necessary equipment in its significant part, and it is difficult to overcome this barrier in many cases. Financial barrier has become an obstacle on the way to the European and American financial markets while investment needs growth still persists. It is hard to pull through the both barriers at the same time, taking into consideration not sufficiently solved problems of technological and financial aspects of Russian nanoindustry development. However, the barriers encountered have not closed the realization of projects, but made it much more complicated.

The Russian Government intends to continue implementing the strategy of nanoindustry and its infrastructure development, considering the unfavorable global environment, using the methods and tools of targeted programming, of selective organizational and financial support for firms and projects on the country and regional scale, aimed at reducing dependence on imports of equipment, component parts and materials.

In times of crisis and sanctions, opposing nano-industrialization processes in the Russian Federation, government intervention in economy is especially important. Lack of the state support for Russian nanoindustry in modern conditions can lead to the degradation of SR&ED (Scientific Research and Experimental Development) or to the use of the achieved results by foreign competitors. An important role in overcoming the negative trends in the national nanoindustry at this stage may also play initiative institutes of its development, partly replacing the institute of state, as

his substitutes, and partly working with him, functionally complementing it, as so-called "completutes". The Russian state and traditional institutes have taken a number of measures to facilitate the functioning of innovative enterprises in the domestic market, but efforts "from above" are not enough for the system creating a favorable environment for nano-industrialization. Only together with representatives of the business, the direction to move in difficult conditions of Russian economic development refraining can be exactly determined. This task is designed to be solved by cross-sectoral, regional and inter-regional associations of employers and employees as initiative institutes of nanoindustry development and self-regulation (Russian Nanoindustry Association, 2015).

The financial, institutional, informational and organizational support for nanoindustry development is already being implemented by most of the powerful development institutes of the Russian Federation, while their system coordination has not achieved yet. A systemic interaction of general and specific, financial and non-financial development institutions, state and private companies on regional, national and global levels should be provided. This gives additional opportunities for effective solving the problem of sanctions confrontation and transition to the new trend of development of Russian nanoindustry adequate the imperatives of its sustainability, competitiveness and security in the global context.

2. Research Objectives and Methods

Research objectives of the study cover: identifying an objective picture of the state and vectors of development of nanotechnology industry in the Russian Federation (the RF) at the present stage; adopting a new strategy for the nanoindustry stakeholders and the mechanism of its implementation; determining the effectiveness of decisions and coordination of the state, institutes and companies in this sphere; justifying the strategic adjustment of parameters (subjects and objects, priorities and imperatives, landmarks and horizons, algorithms and growth) of Russian nanoindustry; assessing the impact of imposition of sanctions on the research and industrial projects implementing perspectives in nanoindustry sphere in the RF, the EU, the US, and other countries.

The study contributes to a real assessment of effects and consequences, to prediction of development and minimization the specific and general risks of the global nanoindustry development caused by sanctions against Russia.

The objectives of this study were solved applying methodology of the systems and evolutionary approaches to the analysis of large and complex objects as Russian nanoindustry taking into consideration the level of its development and the specific opportunistic behavior of "related groups" and the adverse impact of the external environment.

The synthesis of structural and functional, temporal and spatial, aspectual and comparative, statistical and documentary analysis has been realized in the research work. The expert' and authors' quantitative and qualitative evaluation of system dynamics and of Russian nanoindustry current state, as well as a reflection of its new guidelines in the strategy and actions of its stakeholders are represented in the article.

3. Analysis Result

Development of nanoindustry is not only the priority of progress, but also the imperative of survival in the frameworks of the global technological mode, started with the beginning of the century. The global nanotechnology industry will grow to reach 75.8 billion US dollars by 2020 (Nanotechnology Market Outlook, 2015). The global market of final goods and products containing nanomaterials has already made more than 1 trillion US dollars. It features more than 800 consumer products produced applying nanotechnology, and by 2020 more than 15% of the total mass of commodities in the world will be produced using developments in the field of nanotechnology (Information about the results, 2014). The expected compound annual growth rate (CAGR) of global nanomaterial market in 2012-2019 is 15.5%, from 2.0 billion US dollars to 5.5 billion dollars, respectively (Dickson, 2015).

National nanoindustry formation remains the most important area of the Russian government policy. The achieved results of its implementing can be seen in Table 1.

Table 1. Main indicators of Russian nanotechnology industry development, 2010-2014

Indicators	2010	2011	2012	2013	2014
Gross domestic spending on R&D, % of GDP	1.13	1.09	1.13	1.13	1.19
Share of domestic spending on R&D in priority fields (including nanotechnology) in gross domestic spending on R&D, %	56.5	59.2	67.6	65.5	67.9
Number of companies producing products related to nanotechnology, un, incl.:	50	287	384	518	576
Independent producers	33	240	322	440	483
RUSNANO portfolio companies	17	34	62	78	93
Number of developed nanotechnologies, un	222	258	327	411	443
Share of developed nanotechnologies in advanced manufacturing technologies by economic activity, %	25.7	22.7	24.7	28.8	31.4

Number of applied nanotechnologies, un	354	526	748	907	937
Nanotechnology industry output, RUB bn, incl.:	117.9	154.8	210.7	417.6	756.9
Independent producers share, %	99.1	92.7	88.8	81.7	75.3
RUSNANO portfolio companies share, %	0.9	7.3	11.2	18.3	24.7
Nanotechnology products exports, RUB bn	45.8	67.0	66.5	93.9	204.7
Volume of sales of Russian nanotechnology products, RUB bn	117.9	154.8	220.0	522.0	946.4

Source: (Annual Report of the OJSC RUSNANO (2014); Strategy of OJSC RUSNANO (2013); Accounts Chamber of the Russian Federation (2013); Creating businesses. Annual Report (2010)

For 7 years to 2015, RUSNANO Corporation (transformed from the state corporation into OJSC RUSNANO, RUSNANO Group, which implements state policy for the development of nanoindustry in Russia as a co-investor in nanotechnology projects) has received from the state 130 billion rubles in capital and 180 billion rubles in state guarantees for making loans to companies, now fully returned. In 2015, RUSNANO project (portfolio) companies planned to invest in research and development activities more than 20 billion rubles (about 1/3 billion US dollars) (Nanoindustry in the country, 2015). RUSNANO appropriated about 23 billion rubles on investment, and the government can appropriate 50.2 billion rubles grants for RUNANO in 2016-2020 and provide guarantees of about 100 billion rubles for RUSNANO' loans in 2016-2019. The parameters of state support for OJSC RUSNANO to 2020 will be determined upon completion of the first phase of Russian nanoindustry development in the spring of 2016.

Russian nanoindustry growth rate has been 12% per year in 2007-2014, which is significantly higher than the growth of GDP and industrial output in the country. Average labor productivity in nanoindustry enterprises is about 2 times higher than that of the manufacturing industry of the Russian Federation, the share of SR&ED costs of about 2 times higher than in the rest of the domestic economy.

However, in 2013, the pace of commercialization and diffusion of nanotechnologies has slowed down; some enterprises have been forced to change the profile and to start restructuring. The Accounts Chamber of the Russian Federation data for the three previous years clearly shows the decline trend in the growth rate of Russian nanoindustry (Table 2).

Table 2. The planned and actual sales of Russian nanotechnology industry production, 2010-2012

Indicators	2010	2011	2012
Planned sales, RUB bn	155	240	340
Actual sales, RUB bn	122	160	220
Performing share, %	78	66	64

Source: (Accounts Chamber of the Russian Federation, 2013)

Under these conditions, by 2014 the following measures became urgent: accelerating the creation and implementation of metrological support, of systems of special equipment, instruments and devices; reorienting logistics channels of companies; seeking new financial resources and reliable partners; selecting and supporting diversification projects, choosing priorities of import substitution.

At the beginning of 2014, the task of achieving 900 billion rubles (30 billion US dollars) aggregate output in Russian nanoindustry by the end of the next year, with the share of RUSNANO invested companies at least 300 billion rubles per year, and the one of independent (not subsidiary) companies – 600 billion rubles seemed to be problematic, but it was realized. However, is Russian nanoindustry output worth less than 15 billion US dollars nowadays, in conditions of the negative impact of ruble sharp weakening and sanctions imposing?

According to the opinion of Anatoly Chubais, Chairman of the RUSNANO Corporation Executive Board, year 2014 "was difficult for Russian business, including companies in the sphere of nanoindustry" (Chubais, 2014), but 2015 has become a year of transitional way marks and decisions.

After thinking over a new unfavorable situation and a slowdown in Russian nanoindustry development in 2014, the situation in the field of government regulation of the sphere has changed. At the present stage transformation of the investment guidelines for the Russian nanoindustry is carried out. RUSNANO appropriated about 23 billion rubles on investment in 2015, and the government can appropriate 50.2 billion rubles grants for RUNANO in 2016-2020 and provide guarantees of about 100 billion rubles for RUSNANO' loans in 2016-2019 (Nanoindustry in the country, 2015). The parameters of state support for OJSC RUSNANO to 2020 will be determined upon completion of the first phase of Russian nanoindustry development in the spring of 2016.

The revision of government regulation of the sphere also means changing the proportion of domestic and foreign investors' participation in its development. Until the first half of 2014 the partners' shares in foreign direct investment in nanoindustry projects were as follows: 80% by the Russian investors and 20% by the foreign ones. Respectively, 20% of Russian business was allocated abroad: in the

USA, Germany, South Korea, China and other countries. The essence of the current strategic shift is in the transition to action, primarily through private equity funds (PEF), with the proportion of the capital – 50% of OJSC RUSNANO and 50% – of other investors.

Implementing RUSNANO's idea of establishing new investment funds takes place in a difficult political situation, when in fact Western sources of funding have been completely blocked (Rusnano has been impacted on the political situation, 2015). But sanctions don't drive RUSNANO to a standstill: in the circumstances of difficulties encountered there is no project, stopped for this reason. National nanoindustry in Russia continues to expand. RUSNANO has approved a new development strategy until 2020, which meets current global challenges, takes into account the need to counter sanctions, reducing dependence on imports and provides for the acceleration the nanoindustrialization processes on a new financial basis by attracting private capital, developing public-private partnership, creating new investment funds with the involvement of international investors. During this period total capital amount for financing new investment projects raised by RUSNANO group into the portfolio companies and by establishing nanotechnology investment funds is expected to reach 150 billion rubles cumulatively (Strategy of OJSC Rusnano, 2013).

The transition to a new strategy is uneven, it reveals the idealism of intentions, institutional and other barriers, contradictions in the interests of the partners, opportunism in fulfilling their obligations. Creation of the first fund of such a kind (14 billion rubles) was planned in 2014 as a result of the European Bank for Reconstruction and Development (EBRD) participation refusal in the framework of the policy of sanctions against Russia. Later, the reorientation of the Russian Federation on partners from China and Southeast Asia has been held. RUSNANO established a subsidiary company CIRTech RN GP Limited in Hong Kong for the purpose of development and search of ambitious project to invest in HT-sphere together with the Asian partners.

At the beginning of 2015 RUSNANO signed an agreement with partners from China to establish a joint investment fund with the input of each party of 150 million US dollars (or 7.4 billion rubles), but the project has not been implemented. RUSNANO and Tsinghua Holdings Co., Ltd. (China) agreed to establish a joint fund of investment in start-ups in Israel, whose products will be used in the Russian economy. It is assumed that each party will contribute to the fund at 80 million US dollars.

Then RUSNANO decided to create an investment fund at 12 billion rubles with SMP Bank (Russia) instead of the EBRD. Joining the project of SMP Bank, as being under the sanctions, seemed logical. It was assumed that partners will invest in the fund at 5.94 billion rubles; another 120 million rubles will enclose the newly established management company. For 3 years the fund size is expected to be

increased to 30 billion rubles at the expense of other partners have not yet found – both Russian and foreign, but the project is not yet implemented (Salmanov, 2015).

In the fall of 2015 accelerating the recovery processes of strategic trend of nanoindustrialization in the Russian Federation until 2025 has begun. Exactly then RusHydro, RUSNANO and Far East Development Fund signed an agreement of intent to set up an investment fund for direct investment. The participants apply a special form of financial technology – an investment partnership in which the first contributions by RusHydro and RUSNANO will amount to 2.4 billion rubles each. The fund will invest in electric power and related industries projects in the Far East of the Russian Federation (East Economic Forum, 2015).

In the United States RUSNANO ventures fund up to 235 million US dollars can be also established. The idea has been approved by the Board of Directors of OJSC RUSNANO, but the official decision would be made at the general meeting of shareholders, as the Fund will consolidate RUSNANO project companies operating in the United States and Canada (Venture fund Rusnano, 2015).

Priorities of investment funds with foreign partners, establishing by RUSNANO on the principle of parity optimization of the deposits structure, – are investments in technology-oriented companies in nanoindustry that are developing production in the field of import substitution and increasing export potential of Russia.

The current systemic problem of Russian nanoindustry is a gap between the need to conduct SR&ED of proper quality and the ability to ensure the creation of promising groundwork in this area while infrastructure is critically weak. This problem hinders the achievement of domestic firms' required level of competitiveness, sustainability and security on the fast growing global markets for goods and services with nano features. Russian nanoindustry infrastructure is being created as a national network model consisting of organizations of various organizational and legal forms, carrying out fundamental and applied research and commercialization of technologies. Their activities are coordinated by the Government at the cross-sectoral level. The weakest link of nanoindustry sphere remains the logistics of research and development and of production of goods with nano features.

Import substitution policy favoring nanoindustry should have been launched at the beginning of the 2000s when the global transition to a new (nanotechnology sheaf and NBIC convergence based) technological mode was started. Under the conditions of contradictory unity of global forms of cooperation and competition, it is crucial to maintain sustainability and security of a national economy by restraining imports and dependence on imports within the acceptable range. Moreover, it is necessary to limit the openness of nanoindustry sector to save competitive advantage and provide a leading position in certain segments of the global markets for nanoindustry goods. Such a policy should not be rigidly linked to economic sanctions of the modern period.

The logic of joining Russia in the new technological and corresponding socio-economic mode has inevitably obliged the country to develop domestic production for the nanoindustry technological platform. Providing the proportionate developing of human, technical, financial, institutional, organizational and informational capital (taking into consideration cash and in kind forms of corresponding factors of production) becomes the mandatory condition of nano-industrialization. Unfortunately, now the purpose of the statements of the import substitution for the Russian nanoindustry as burning priority, especially among politicians, is often just a kind of populism. However, import substitution has its advantages and disadvantages, its potential is limited; it generates positive and negative externalities and internalities for participants of external transactions in the sphere of circulation of goods and services for nanoindustry.

In 2014, in many cases, foreign partner companies and financial institutions in the sphere of nanoindustry reduced the possibility of cooperation, hindered discussions of transactions, since, in their opinion, an unstable political situation took place. Although embargo was not announced, but concerns to work with companies in Russia was persisted. This situation had a negative impact on the dynamics of the Russian nanoindustry evolution. The fall of the ruble against the dollar affected the industry in two ways: on the one hand, there was a serious, heavy blow for the projects of Russian companies with the need for the imported equipment and the import contracts already signed. On the other hand, the shift in exchange rate for export-oriented nanotechnological projects (which brought more than 90 billion rubles in 2014) is "just happiness fallen down from the sky providing a double income for the same amount of revenue" (Chubais, 2015).

The need for the partial substitution of imported equipment, materials and information providing Russian nanoindustry development is indisputable to ensure domestic companies competitiveness in the global markets in the future. A presence of similar goods that have at least similar quality characteristics on the Russian market has become a limitation to the process of such a substitution and of import goods refusal.

For industries where such analogues or alternatives with similar characteristics are available, the introducing of the preferences for the use of domestic equipment will force businesses to develop production.

For example, in Russian vacuum technology industry situation with domestic counterparts is quite complicated. At present stage, the existing Russian technologies lag behind the foreign ones, and it may take years to change the situation. It should be understood that in recent decades foreign partners have successfully conducted research and development, incorporating the results into production development. Thus, Intech Analytics, one of the largest companies in the market for vacuum equipment, is engaged in import deliveries, providing numerous long-term projects

based on foreign equipment applying, which has no Russian analogues. Sanctions cause a lot of problems for company's customers, because their projects are either approved or are being currently negotiated, and for many of them budget funding has been already allocated. In order to ensure meeting the obligations undertaken, the company is forced to increase the stock of goods in warehouses, providing customers' orders for at least 6 months in advance.

Forming modern and reliable production systems at the Russian public and private enterprises in the nuclear, aerospace and other industries requires delivery of the high-quality vacuum components. Therefore, imposing total import substitution in the vacuum industry is not appropriate at this point of time. Therefore, total import substitution in the vacuum industry is not appropriate at this point in time (Lovtsyus et al., 2014).

For one thing, the sanctions have not yet affected the industry of analytical instrumentation for investigation of topography and mechanical properties of nanomaterials. There are no administrative or political restrictions implemented by the Unites States and the European Union, or by the Russian Federation. The dynamic exports of Russian appliances to the markets of these countries are taking place as well as the imports of nanotechnologies measuring instruments from there.

But then, the imposition of sanctions is manifested indirectly in the form of containment or reduction of funding for potential customers of our equipment, since many of them have the status of the budget organizations (educational and research ones). The offset of reducing the number of Russian customers is conducted by increasing the share of exports of our products. There again, the implementation of sanctions may be noticed as the containment or reduction of funding of potential customers of Russian equipment, since many of them are budget organizations (education institutions and research organizations). Domestic exporters have even benefited under the dollar exchange growth against ruble in 2014-2015.

The sanctions topic is hardly discussed in the negotiations on specific export-import transactions, but delays in deliveries of some components from abroad take place. It is not only the case of sanctions, although suppliers now use the problem exists as a cover to their issues with conscientiousness and imperfect logistics management. This is true for those companies that import goods and equipment for nanoindustry, for example, from China either using the traditional channels or reorienting them.

However, despite the difficulties, there are significant breakthroughs in this area. The RUSNANO's portfolio company «OCSiAl» (Novosibirsk) has created the world's first scalable industrial production technology of single walled carbon nanotubes with the costs of production about 75 times lower than that of known analogues. In the next 2-3 years it is expected to achieve the annual output of the product at 30-40 tons, while the supply on the world market amounted to only 2 tons in 2014.

The 12th RUSNANO Nanocenter (Center for nanotechnology and nanomaterials of the RUSNANO network) was founded in the Republic of Mordovia (the Russian Federation). The main purposes of the center are commercializing innovative nanotechnologies, launching start-ups and transforming them into successful high-tech businesses. By the time of the center's launching, 49 projects on power electronics, lighting engineering, instrumentation, nanomaterials in the construction have been approved. They will be implemented in cooperation with foreign partners. The total Nanocenter's budget amounts 1.97 billion rubles, including 1.15 billion rubles of RUSNANO' Fund for Infrastructure and Educational Programs investments (The 12th Center of nanotechnology, 2015).

The first manufacturing of telecommunication optical fiber has also been launched in the Russian Federation. The project was implemented by the RUSNANO's portfolio company JSC "Fiber optic systems", with the participation of Gazprombank and the government of the Republic of Mordovia. It is the 60th plant built by RUSNANO in Russia. Until now Russia's demand in fiber has been met completely by imports. The capacity of the plant (2.4 million km of telecommunication optical fiber per year) will allow reducing imports by 50% in the first years and almost doubling the output in the next 2-3 years. The project cost is 2.7 billion rubles including 1.3 billion rubles of RUSNANO investment. The government support has allowed launching the project in a short time and providing incentives for import substitution in the sphere of fiber optics (The 60th Rusnano plant, 2015).

The import substitution of goods for Russian nanoindustry is a very complex and broad-scale issue affecting the overall national nanoindustry activities – from megascience centers (MSC), and centers for collective use (CCU), clusters and special economic zones of technological innovation and industrial type to individual enterprises of nanoindustry and of all types of its infrastructure, research groups and employees.

Despite the lag in the production of consumer goods, Russian manufacturers remain the leaders in the production of critically important goods based on the newest aerospace, military and nuclear technologies. These products are difficult to buy on the scale required reliably, profitably and safely on the global markets. The striking example is the incident with the contract for the two Mistral helicopter carriers' supply which had been signed in June 2011 between DCNS group (France) and Rosoboronexport (Russia). Return on compensation for contract non-fulfillment for the Russian Federation is still uncertain, but due to changes in exchange rates a double offset in the ruble mass has been got.

In order to achieve industrial scale in the branches of strategic importance providing Russian Federation leadership on the global scale in the present and the future, for the past 15 years technological base modernization is being held. This process also

covers production of a part of equipment that is not only inferior, but in many ways is superior to foreign analogues; this conclusion has been confirmed by a number of comparative tests. At the same time marketing and advertising areas are lagged behind; brands of domestic goods based on nanotechnology are not yet developed. This problem concerns not only to technical devices or the scientific equipment and special nanomaterials, but especially to consumer goods such as textiles, medicaments, household appliances, cosmetics etc.

Import substitution of equipment or component products for Russian nanoindustry and its infrastructure expands customer choice opportunities by enabling them to find more effective solutions based on comparisons and experience. Sometimes the superiority of foreign import analogues is only an "advertising bubble" inflated with huge investments and foreign brand managers' efforts. In these particular cases fast import substitution is possible by expanding already adjusted production scales and promoting goods on the domestic and foreign markets.

At the time of purchase the imported appliance for SR&ED or manufacturing nanotechnology it is often almost impossible to estimate its working functions and effectiveness as well as the results obtained until the user buys it and sets to work. In addition, the commodity complexes and the devices and equipment maintenance in the sphere of nanoindustry are developed insufficiently. The procedure of getting a high-quality maintenance and skilled consultancy servicing on the running of a majority of imported equipment, its integrated or combined applying in research process is very complicated and expensive in nanotech sphere. Such problems do not become acute in case with domestic analogues due to the ease of approbating and supplying the necessary domestic materials, tools, devices and equipment without significant growth in customers' costs.

The import substitution policy in the sphere of services for nanoindustry does not really matter, as the main means of ensuring security, service and support to set up production at domestic enterprises have been developed on the basis of domestic research and design institutes; they are regulated by standards of the legislation and the authorities of the Russian government.

Experts believe that the import substitution policy should generally have a positive impact not only on the production of instruments and other equipment, but also on other components of all branches of Russian nanoindustry. Undoubtedly, the import substitution for nanoindustry is not a short-term policy; it has been not fully comprehended and implemented yet, but it rapidly gains power and scale.

The integration unions, such as the Shanghai Cooperation Organization (SCO), the Eurasian Economic Union (EAEU), the Commonwealth of Independent States (CIS) and BRICS, are of great importance for overcoming the modern problems of Russian nanoindustry development. At the beginning of 2015 the analysis of current state and development of nanoindustry was carried out, its problems and barriers in

the EAEU countries were disclosed (Information about the results, 2014). So, there is a low demand from the business, government agencies and institutions on nanoindustry products along with a high share of import in it. According to the Eurasian Economic Commission (EEC), the volume of import nano-enabled goods is estimated at the level of 15 billion dollars per a year, or 5% of the total. Nevertheless, it was revealed that participating countries conduct consecutive work through adoption of national programs and initiatives on the development of this sphere; and this work was estimated as capable to provide increasing the competitiveness of many branches, especially the manufacturing industry. Moreover, cooperation in the NBIC-technologies creates new industries and can be a successful way of overall progress of EAEU countries' industrial complexes.

Within the Eurasian integration there is a successful experience of the interstate innovative cooperation in nanoindustry. Russian–Kazakhstan Nanotechnology Fund has been established, the series of scientific and technical programs of the Belarus-Russia Union State is being implemented, the Non-profit partnership "International Innovative Center of Nanotechnologies of the CIS Countries" has been created and others. There are more and more examples of successful project implementation on the basis of megacollaborations in the industrial sector (a series of projects involving companies within the RUSNANO group).
On the basis of the results of analysis mentioned above the EEC has prepared the offers on development of the EAEU countries interaction in the sphere of nanoindustry providing measures for deepening of scientific and technical cooperation, creating the joint ventures for manufacturing the innovative and hi-tech products based on nanotechnologies. It is supposed that these offers will be issued in the form of recommendations and after multilateral coordination will be submitted for consideration by governing bodies of the integration union.

In the current situation the following question arises: "Is there any chance for Russia to become one of the technological leaders in the future?". It is impossible to answer this question unambiguously. One can find the answer from the optimistic and pessimistic points of view.

An optimistic point of view. Despite a slight gap to the leaders, in 2007 Russia adopted a strategy of forming a nanotechnology industry and defined its main goals, as a response to one of the major challenges of the XXI century. At the first stage (10-12 years) it is impossible to achieve the full development of nanoindustry within the dynamics evolution model of a new technological mode. Optimum period of time is from 20 to 25 years. The first stage groundwork is potentially capable to accelerate or slow down the process of nanoindustrialization. Technological reserves are developed in SR&ED, education and industrial sectors, as well as in defense, information and communication sectors that have become the main exporters of Russian nanoindustry production.

A pessimistic point of view. The lag in competition, weakness and caution, opportunism of interests, administrative barriers, redundancy of mediators, desire to shift the burden of innovation at the state and so prevent to reduce the costs of new technologies implementation. The stronger is the monopoly and bureaucracy, the weaker is competition, the less are its effects, – and the more are the barriers to the initial incentives to innovative economic development. This creates the mechanisms of nanoindustry development restraint.

4. Conclusion

The analysis of Russian nanoindustry current state and unstable dynamics in conditions of economic and political sanctions, and unstable external environment allows making the following concluding observations:

– Russian government retains the support system of national nanoindustry in accordance with the general strategic goals of the economic policy, but it replaces emphasis, moving mostly from investment to guarantees, to the institutional and metrological maintenance;

– Phased persistent transition from the domination of companies' and projects' budgetary financing to private investing in companies and special economic zones on the basis of systems of participation and corporatization is required;

– Imposition of external sanctions against Russia has led to the priority of private equity investment funds in the development of national and international nanoindustry, to the restructuring of investment subjects' composition and investment proportions;

– Russian companies refuse to cooperate with unreliable partners; seek to form new clusters and strategic alliances in nanoindustry sphere, review inefficient agreements and treaties with foreign companies;

– Companies of Russian nanoindustry reorient to new suppliers of equipment and materials, form the new "related groups" for cooperation and collaboration;

– Along with the growth of import substitution it has been expressed willingness to intensify the export activity in Russian nanoindustry;

– State target programs and projects with state participation on the developing and introducing of functionally complete system of domestic special and measuring equipment, and elaborating scientific instrumentation industry for the needs of nano-industrialization and NBIC-convergence in various spheres of life and sectors of the economy are implemented;

– Restructuring a global network of partners on criteria for parity of responsibility and profitability, sovereignty and urgency in order to prevent and overcome the problems of isolation and backwardness of each party cooperating in the global nano-industrialization process is continued;

– Modernizing the institutional framework and actual activating the government policy in the sphere of innovation along with the systematic stimulation

to accelerate the innovative processes in the sphere of nanotechnology has been initiated.

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