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Innovative and industrial development: specifics of interrelation

Abstract. An analysis of methods to overcome the crisis of 2008 and the dynamics of post-crisis development in countries around the world has shown that the less significant was the impact of the crisis on the economy, in which there is a more developed industrial sector. Accordingly, the actual problem is to stimulate industrial development. At the same time, the specificity of the current stage is that it requires not only quantitative changes in the volume and structure of industrial production, but also qualitative transformations. They are associated with the promotion of innovative technologies within production. The purpose of the article is to study the innovation and industrial development, as well as specific circumstances of such a process taking into account existing institutional constraints observed both in our country and abroad. The authors used theoretical and empirical methods to conduct the present research, in particular the methods of literature review, retrospective, logical and systematic analysis and statistical research methods. The article presents the results of the analysis of socio-economic and industrial development of countries in the post-crisis period in relation to the process of innovation development. The authors have found out that the developed industrial potential of innovation substantially contributes to sustainability of economy during a crisis. They have offered directions in which it is possible to stimulate innovative development of industry in the post-crisis period. The article deals with the specifics of the interrelation between of innovation processes and production potential of industries. It has been determined that industrial and innovation policies in the post-crisis period should be one of the priorities of state regulation of the economy. It is indicated that this regulation must be more responsive to the country-specific interrelation between innovation and industrial development. The authors have shown a need for the «new industrialization» a number of countries around the world, based on the introduction of innovative technologies into production.

Keywords: Industry; Innovation; Government Regulation of Economy; Socio-economic System

JEL Classification: L52; O32

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Иновационное и промышленное развитие: специфика взаимосвязи

Аннотация. Стимулирование инновационного развития – одна из важных целей современной экономической политики. При этом часто предпринимаются попытки её достижения без учета уровня промышленного производства, что приводит к неэффективному использованию ресурсов. В статье, на примере российской промышленности, выполнена оценка взаимосвязи промышленного и инновационного развития. На этой основе обоснованы рекомендации по повышению качества экономического регулирования.

Ключевые слова: промышленность; инновации; государственное регулирование экономики; социально-экономическая система.

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Інноваційний та промисловий розвиток: специфіка взаємозв'язку

Анотація. Стимулювання інноваційного розвитку є однією з важливих цілей сучасної економічної політики. При цьому часто робляться спроби її досягнення без урахування рівня промислового виробництва, що призводить до неефективності використання ресурсів. У статті, на прикладі російської промисловості, запропоновано оцінку взаємозв'язку промислового та інноваційного розвитку. На цій основі запропоновано рекомендації щодо підвищення якості економічного регулювання.

Ключові слова: промисловість; інновації; державне регулювання економіки; соціально-економічна система.

1. Introduction. The problem of innovative development of socio-economic system is actual for many countries, for both the developed and the developing world [1]. Innovative socio-economic changes whether quantitative (economic growth

acceleration, increase in production volume and consumption, etc.) or qualitative (customer satisfaction upgrading, improvement of the environmental performance, etc.) are associated with innovations.

In this regard, this is not accidental that the United Nations Development Programme (UNDP) pays considerable attention to innovations, pointing them out as the main driving factor of the progressive development of our time [2]. At the same time, the issues of innovative development are considered somewhat separated from the issues of industrial development. For example, in the report on global industrial development for 2013, prepared by the United Nations Industrial Development Organization (UNIDO) [3], the creation and distribution of innovations are not considered and the issues of interrelation between innovation and industrial development are not analyzed. Similarly, in the long-range materials of UNIDO [4] no attention is paid to the mutual influence of innovation and industrial growth. Therefore, this research represents particular interest and it is relevant to examine the interrelation between innovative and industrial development.

Due to the emergence and recognition of the concept of post-industrial society, less attention has been given to industrial development in economic studies [5]. If they are discussed, then, as a rule, in the context of solving problems of sustainable development or the model implementation of catching-up development by emerging nations. At the same time, the problem of innovative development has gained increased popularity among researchers. Its fundamental dependence is defined by «tightening» of the economic time, reduced life cycle duration of modern goods, services and technologies, which requires ongoing renovations realised through innovation. Innovations are realised mainly in the production sector. Even those of them which, at first glance, are not directly related to the production (e.g. the innovations of public management of the e-government technology), are finally based on changes in the industry. Indeed the equipment used for e-government must first be invented, designed and produced at the industrial enterprises. Only then it is possible to use it in public management effectively. Thereby, innovations and industrial development are closely linked. Thus, the current scientific and practical issue is to identify the nature of this link.

2. Brief Literature Review.

In recent years, considerable attention is paid to the issues of innovative development of economy since innovation is recognised to be one of the key factors of competitiveness. Thus, in publications cover specific applied ideas and developments, which possess innovative capacity and prospects of commercialisation [6; 7; 8, etc.], as well as formation, development and institutional management of national, regional and industrial innovative systems [9; 10; 11, etc.].

Thus, the issues of interrelations of innovative and industrial development are mentioned in a fragmented manner, i.e. using examples of certain countries and industries or specific mechanisms of production and innovative integration [12; 13; 14; 15; 16; 17, etc.]. To create an integral consistent concept describing the economic relations in this area, it is not enough to accumulate only empirical data.

At the same time, the necessary preconditions for the enhancement of researches in this field are now starting to appear. These preconditions are connected with the transformations in the real economy including those caused by the crisis of 2008. Today a considerable number of experts [18; 19; 20; 21, etc.] and institutional structures (at the international,

national and regional levels) come to a conclusion that it is required to change attitudes towards industrial development. Therefore, we can see a growing interest in the industrial policy and in taking measures designed to implement the «new industrialisation», including in the developed world.

Within this framework, we consider it rational to take a coordinated decision concerning the industrial and innovative development which requires intensification of the relevant theoretical and empirical research.

3. The purpose of the article is to find out the specifics of interrelation between innovative and industrial development on the basis of data analysis of the Russian economy.

4. Results. The analysis of the official data of the Federal State Statistics Service of the Russian Federation, submitted on its official website (www.gks.ru) has revealed that in recent years the innovative activity of Russian industrial enterprises remains steadily low (Table 1). During the last five years, the share of the organisations performing technological, organisational and marketing innovations has not changed much and is approximately about 10% of the total number of organisations. Thus, the innovative activity is higher in those economic activities which have undergone more advanced technological changes: during the specified period (2010-2014) the innovative activity in manufacturing industry averages (average number) 13.3%, in mining – 7.9%, in production and distribution of electricity, gas and water – 5.4%, with an average value for the industry as a whole it is about 10%.

Tab. 1: Innovative activity of Russian industrial enterprises by types of economic activity, %

Type of economic activity	2010	2011	2012	2013	2014	5-year average
Total	9.5	10.4	10.3	10.1	9.9	10.0
Mineral production	7.8	8.4	8.2	7.6	7.5	7.9
which includes:						
Production of fossil fuel	9.7	11.3	10.0	8.6	8.5	9.6
Mineral production except for fossil fuels	5.3	4.5	5.8	6.3	5.9	5.6
Manufacturing industries	13.0	13.3	13.4	13.3	13.6	13.3
which includes:						
Food production including beverages and tobacco	11.6	11.8	11.9	11.0	12.5	11.8
Textile and clothing manufacture	8.9	8.2	8.6	8.5	10.0	8.8
Leather manufacture, leather goods and footwear manufacture	11.1	8.0	6.8	11.5	12.6	10.0
Wood processing and wood products manufacture	4.9	5.5	6.0	6.8	7.4	6.1
Pulp and paper production; publishing and printing activities	3.8	3.5	3.4	3.7	3.0	3.5
Manufacture of coke and petroleum products	32.1	31.7	31.7	29.0	25.7	30.0
Chemical production	25.3	23.6	22.8	25.0	23.1	24.0
Manufacture of rubber and plastic products	11.3	12.1	12.0	11.7	12.4	11.9
Manufacture of other non-metal mineral products	8.9	9.7	10.3	10.0	9.3	9.6
Metallurgical production and finished metal goods production	14.9	15.4	15.6	14.8	14.7	15.1
Machinery and equipment production	17.1	17.7	16.7	15.9	15.9	16.7
Production electric, electronic and optical equipment	26.0	26.5	27.9	26.9	28.3	27.1
Production of transport vehicles and equipment	21.4	21.4	21.8	21.5	21.2	21.5
Other productions not included in other categories of manufacturing industries	16.2	17.3	15.5	15.3	15.8	16.0
Production and distribution of electricity, gas and water	5.4	5.6	5.6	5.3	5.1	5.4

Source: Composed by the authors based on the Federal State Statistics Service data

Official statistics provides data on innovation activity only until 2014. This is determined by the organisation of statistical data monitoring system in Russia. The form of statistical observation No 4-Innovation «Information on the organisation of innovative activity» for the preceding year shall be submitted by enterprises on 31 August. Accordingly, the official data for 2015 will be collected only in the second half of 2016, and will be processed at the end of 2016.

In this connection, it is interesting to obtain the forecast of Russian companies' innovative activity in the current period and for the future. We have fulfilled the forecast of innovative activity in 2015-2016 with the use of a linear trend and an exponential trend (Table 2). This is the inertial scenario. It is based

on the continuation of the trends identified in previous years. As can be seen from the results, innovative activity in the industrial sector in general, as well as in manufacturing industries will not exceed the average level for the previous five years. We expect the level to be above average in mineral production and production and distribution of electricity, gas and water.

Our results are consistent with data obtained by other Russian experts [22]. The Center for Science Research and Statistics gave a forecast of innovative activity of the Russian industry considering two scenarios. In the baseline scenario, the level of industrial innovation activity in 2015 will be 8.2%, in 2016 – 7.6%. According to the optimistic scenario such an activity is predicted at the level of 8.2% in 2015, whereas in 2016 it is expected to show 7.7%. There exist several lower rates of activity (compared with our forecast) due to the introduction of restrictions on funding in these scenarios.

If we compare the above figures with the number of Russian industrial enterprises during the similar period (Table 3), the picture turns out even more impressive. Only about 1.4 thousand of mining enterprises and about 2.2 thousand of those involved in production and distribution of electric power, gas and water were innovatively active. In manufacturing industries, about 19 thousand of innovatively active organizations were in operation, which is five times as much. The result is that only promotional development of the manufacturing industries will accelerate the innovative development of the economy as a whole.

It should be noted that the given indicators are considerably lower than the same indicators in the developed countries of the world. According to the Ministry of Economic Development of the Russian Federation, the level of innovative activity of enterprises, for example, is more than 7.5 times higher in Germany, about 6 times higher in Ireland and Belgium, about 4.5 times in Estonia and the Czech Republic if compared with the level of innovative activity in the Russian Federation. The result is logical: in the Global Innovation Index (version of 2015) Russia takes only the 48th place among 141 ranked countries of the world [23].

One of the key reasons for this situation is the fact that efforts to stimulate innovation are «cut off» from the industrial policy. It is not accidentally that in the abovementioned rating Russia has a very modest figure for the private index «Institutions» (the 80th place in the world). Moreover even the legislative regulation of innovative and industrial activity in the country is performed by various not closely related laws (Federal Laws of the Russian Federation, as of 31 December 2014 No. 488-FL «On industrial policy in the Russian Federation» and as of 23 August 1996 No. 127-FL (as amended on 13 July 2015) «On science and state scientific and technological policy»). As a result, it turns out inefficient and inconsistent. In our opinion, it is necessary to harmonise the institutional framework of state regulation of innovation and industrial development.

The statistical analysis of the data presented in Table 1 shows the stability of innovative activity of the enterprises. The average relative deviation of this index for the industry in general constituted 4.2%, and it was less than 0.8% for the manufacturing industry. Taking into account that the economic dynamics during 2009-2013 differed, the level of innovative activity of the Russian manufacturing industry weakly depends on short-term factors of economic environment. It depends on more essential parameters, which are of long-term, strategic (maybe mental) nature.

Tab. 2: Trends in innovative activity of Russian industrial enterprises by types of economic activity, %

Type of economic activity	5-year average 2010-2014	Linear trend		Exponential trend	
		2015	2016	2015	2016
Total	10	9.9	10.0	9.9	10.0
Mineral production	7.9	8.2	8.0	8.2	8.0
which includes:					
Production of fossil fuels	9.6	10.6	10.2	10.7	10.1
Mineral production except for fossil fuels	5.6	5.0	5.2	4.9	5.2
Manufacturing industries	13.3	13.1	13.2	13.1	13.2
which includes:					
Food production including beverages and tobacco	11.8	11.6	11.6	11.6	11.6
Textile and clothing manufacture	8.8	8.3	8.6	8.4	8.6
Leather manufacture, leather goods and footwear manufacture	10	8.7	9.3	8.6	9.1
Wood processing and wood products manufacture	6.1	4.9	5.5	4.9	5.4
Pulp and paper production; publishing and printing activities	3.5	3.8	3.6	3.8	3.6
Manufacture of coke and petroleum products	30	33.1	31.7	33.3	31.7
Chemical production	24	24.6	24.3	24.5	24.2
Manufacture of rubber and plastic products	11.9	11.5	11.7	11.5	11.7
Manufacture of other non-metal mineral products	9.6	9.4	9.5	9.4	9.5
Metallurgical production and finished metal goods production	15.1	15.3	15.2	15.3	15.2
Machinery and equipment production	16.7	17.5	17.1	17.5	17.1
Production of electrical, electronic and optical equipment	27.1	26.1	26.6	26.1	26.6
Production of transport vehicles and equipment	21.5	21.5	21.5	21.5	21.5
Other productions not included in other categories of manufacturing industries	16	16.6	16.3	16.6	16.3
Production and distribution of electricity, gas and water	5.4	5.6	5.5	5.6	5.5

Source: Composed by the authors based on the data from Table 1

In this regard, the results of the research of innovative activity of the Russian large business conducted by the rating company «Expert» in 2010-2011 could be put in doubt. It attempted to identify the reasons of the low innovative activity of enterprises (according to the responses of their heads). Among those were: resource insufficiency (staff shortage; small amounts of public financing and co-financing of innovation, the lack of tax credit system); also there was a conflict between research and development carried out by the scientific and technical sector and the industry requirements.

In view of the above, we are sceptical of opinion that resource insufficiency is the main constraining factor of innovative development [24, 25]. Thus, we consider the second factor, i.e. a conflict between research and development and realities of industrial production and the markets, to be more essential. It occurs so because of the existing «gap» in the regulation of innovative and industrial development.

In case of stimulation of innovative activity the main attention is paid to the first stages of the lifecycle of innovations. The Skolkovo Foundation, a Russian venture capital company, and many other entities of the national innovative system are responsible for the performance of such activities. At the same time, the insufficient attention is paid to the final stages of the lifecycle. That includes innovations and diffusion, transformation of an innovative product into a traditional one (not at the

Tab. 3: The quantity of the industrial operating enterprises and organisations in Russia by types of activity (at the end of year)

Type of economic activity	2009	2010	2011	2012	2013	Structure 2013, %
Mineral production	17,552	17,314	17,240	17,280	17,432	3.86
Manufacturing industries	418,601	402,479	403,942	404,959	401,872	88.99
Production and distribution of electricity, gas and water	28,545	30,332	31,191	31,903	32,271	7.15
Totals in industry	464,698	450,125	452,373	454,142	451,575	100
Growth rate in the number of organisations	-	96.86	100.49	100.39	99.43	

Source: Composed by the authors based on Russian Industry. 2014: Statistics digest / Rosstat. M., 2014; Russian Industry. 2012: Statistics digest / Rosstat. M., 2012.

expense of technical obsolescence but due to a large-scale expansion), which requires close interaction of the specified organisations and authorities with industrial business.

5. Conclusions. Accelerated innovative development is a pledge of high competitiveness and long-term sustainability of economic growth. The analysis has shown that an attempt to solve this ambitious task is often made without taking into account the level of development of industrial production and apart from the enhancement of institutional incentives and a state regulatory policy of the national industrial development. This naturally leads to the low efficiency of efforts. As the study shows, industrial development and innovative development are closely connected. It requires an integration of approaches to management at all levels of hierarchy of the socio-economic system.

Thus, the complete theory of regulation and self-regulation of industrial and innovative development has not been developed yet. In this regard, an important research objective is to collect and generalise empirical data relevant to the interrelation between these two development lines, taking into account the specifics inhering in socio-economic systems.

Having analysed the Russian practice of industrial and innovative development and its institutional support, the authors came to the conclusion that there is a necessity of priority encouragement of the manufacturing industry, on the basis of harmonisation of industrial and scientific and technological policies.

The major findings from our study are summarised as follows. The level of innovative activity of the Russian manufacturing industry weakly depends on short-term factors of its economic environment as well as on the financial support of innovative activities. To a greater extent an innovative activity of the manufacturing industry is caused by factors of long-term or strategic nature. Hence, it is necessary to pay the main attention to such factors. Finally, there is an inconformity of innovative development to realities of industrial production and the markets which requires a review of the development lines of the national innovative system; its reorientation to support innovations at the final stages of their lifecycle (promotion and diffusion). It requires close interaction between the elements of the innovative system and authorities with the industrial business.

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