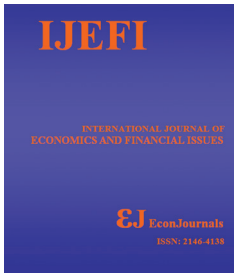

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Technology Platforms as an Efficient Tool to Modernize Russia's Economy

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ABSTRACT

There is an urgent need to consider the dynamic development of the global economy from the point of view of its positive impact on competitiveness improvement in national manufacturing industries, and the best ways to modernize the country economy. The purpose of the paper is to provide with perspectives for development of instruments related to technology platforms (TP) within the framework of innovation management and adapted to the conditions of Russia's economic reality. The major method in studying this issue is mathematical economic modeling which has made it possible to facilitate expediency in determining a TP as an effective innovation control instrument. The paper considers European and Russian experience in deploying TP, and identifies national features characteristic to the performance of the innovation management instrument. A mathematical economic model is used for justifying the efficiency of introducing TP into Russian institutional innovation system. The practical significance of results and conclusions is in its ability to improve the mechanisms of developing and implementing federal and regional innovation development programs, development of the innovation infrastructure, stimulation of the innovation activity, use of a set of TP instruments by public authorities.

Keywords: Technology Platforms, Innovative Development, Modernization, Triple Helix
JEL Classifications: C02, C18, O21

1. INTRODUCTION

The dynamic development of world economy, transition to the sixth technological structure, appearance of new instruments of innovation control, necessity to improve competitiveness of domestic products are the incentives to find better, more optimal ways to modernize the country economy.

The important tasks in upgrading the activities of institutions, activities leading to successful innovation and development, are associated with interaction of innovation market components with the aim of ensuring effectiveness of commercial scientific developments, and eliminating an institutional gap between R and D and manufacturing sectors of economy. The institutional gap is a situation when the information flow from science and research sphere into manufacturing one is not always (at all stages) accompanied by support from innovation institutions (they are either totally absent or poorly developed). This phenomenon was called a "death valley" in the theory of innovation management. In Russia institutional gaps are particularly visible, and the attempt of their replenishment has been made within the frames of technological platforms or a set of industrial engineering companies.

The effectiveness of introducing the technology platforms (TP) into the economy has been confirmed by European experience. However, under the Russian conditions, its introduction encountered a number of problems. First of all, the process is rather costly at the initial stages of this innovation commercialization process, which is connected with the ineffective cooperation of

the key participants of the innovation management instrument (science, business, government), and ineffective functioning of economic environment.

High cost of research, high risks, inadequate legal and regulatory framework responsible for financing the innovation process result in dramatically decreased incentives for successful innovation activity. The study of this issue has been presented by a number of researchers: Etzkowitz (2002), Leydesdorff (2005), Satinsky and Bouthot (2011), Dezhina and Kiseleva (2008), Smorodinskaya et al. (2012), Araslanova (2011), Drobot et al. (2011), Shmatko (2014), Shinkevich and Shinkevitch (2011), Druzhinina (1991), Shurkina et al. (2015). However, in spite of many attempts made, the problems of effective interaction of innovation agents within the framework of the TP and the problems in assessing their performance have not been solved yet.

2. METHODOLOGICAL FRAMEWORK

2.1. Theoretical Basis

The theory is based on both basic and applied research of a model and institutional foundation for innovative processes conducted by domestic and foreign researchers. The subject deals with a TP as a tool to modernize Russia's economy. The objectives of the study are:

- Comparative analysis of the European and Russian experiences of introducing TP, development of Michael Porter's typology of economies on the basis of TP.
- Development of the model for quantitative estimation of TP effectiveness.

2.2. Research Methodology Used

The basic methods of research are methods of formalization, analysis and synthesis, and combination of methods of economic and mathematical modeling. Application of the methods indicated accompanied with analysis of extensive factual and statistical material contributes to objectivity of conclusions.

2.3. Stages of Research

The process of research involved:

1. Study of TP implementation experience in Europe and Russia.
2. An alternative institutional trajectory of innovative development with the use of technological platforms.
3. A mathematical economic model of developing a TP.

2.4. Theoretical and Practical Significance of the Research Results

Theoretical significance of the study lies in the concept of TP development as a mechanism of the alternative institutional trajectory of innovative development which extends the basic concepts of the innovation management theory in relation to creation of innovative environment and determining directions, forms and methods of perspectives to develop the innovation infrastructure.

The practical significance of results and conclusions is in its ability to improve the mechanisms of developing and implementing federal and regional innovation development programs, development of the innovation infrastructure, stimulation of the innovation activity, use of a set of TP instruments by public authorities.

3. RESULTS

3.1. European and Russian Experience in Implementing the TP

European TP are a representation, or sample, of rapid innovation development. One of the most important aspects within the framework of comparative analysis it is worth to mention the structure of participants. According to results of the studies carried out by Tomsk State University, business plays the dominating role in TP (45%) in Europe. The portion of science in the structure of participants makes up 40%, and only 9%-government organizations. This ratio is caused by the fact that it is European large business that is interested in urgent research and developments within the framework of the real segment of the economy, and therefore, it initiated creation of European TP. Due to predominant portion of business and science in the TP of European national innovation systems, the issue of government priority there is either absent or quite weakly expressed.

At present, Europe continues to develop a TP tool converting organizational structure of European TP, forming new types of TP, attracting not only researchers and the representatives of business, but also the financing institutes, organizations representing interests of citizens, i.e., contributing to competitiveness of European sectors of economy.

In Russia, on the contrary, it is the government who is the initiator in developing TP, and this explains its dominant role in the participants' structure of the Russian TP. This distribution of roles specifies the distinctive feature of Russian technological platforms - a low share of business participation. Despite sustained funding, the platforms, as generators of new R and D projects, appeared to be rather weak, and this has been proven by the experiences of both the Ministry of Economic Development and Ministry of Education and Science. The low percentages of scientific topics, or themes, approved by a coordinating research council and poor quality of a task completion have created shortcomings and problems in TP functioning in Russia. Unfortunately, Russian scholars do not have any links with a private sector since there is no pressure on business representatives. One of the problems in Russia's TP is caused by the fact that there is still no assessment criteria developed for self-appraisal of the platform effectiveness. The main emphasis is made on two parameters: Joint implementation projects and finance involved. These are the most obvious indices because, at the same time, they are the tasks that required development of the platforms as the means to solve them.

There has been a predominating interest in them expressed in business segment (30%), universities (23%) and research institutes (22%). However, business interest has not been supported its implementation: Extremely low activity index of the business collaboration with R and D institutions. Furthermore, one of the tendencies in the dynamics of the participant structure is increase in the number of higher educational institutions accompanied

with simultaneous reduction in private sector of the economy and R and D organization, i.e., the private sector's attitude to the Russian innovation system has been regrettably passive. Consequently, a new term "coercion to innovations" has been coined here. So far, "coercion" refers to only public corporations. Complex analysis of Russia's TP showed that their potential as an instrument of innovation management has not been used to its full extent. The specific character of TP still remains obscure and potential and mechanisms of government support have not been determined. While Europe has been modifying the structure and principles for TP functions, Russia should develop the prospecting and promising trends of TP interaction with other instruments of innovative development, first of all, through clusters. It is a challenging opportunity for Russia's TP to collaborate with the European ones through information and idea exchange, experience share and joint financing of the promising innovation projects by European countries and Russia.

3.2. Trajectory of Innovative Development in the Framework of the TP

The government, of course, is not able to support all branches of industry; therefore, TP that are able to consolidate high-tech, state-of-the-art, sub-branches (new materials, hydrocarbon processing industry, energy efficiency, energy conservation, nuclear power, etc.), and low-tech conventional and raw material industries (the mineral fertilizers, petroleum products, mining (except for energy fuels), metalworking manufacturing, etc.).

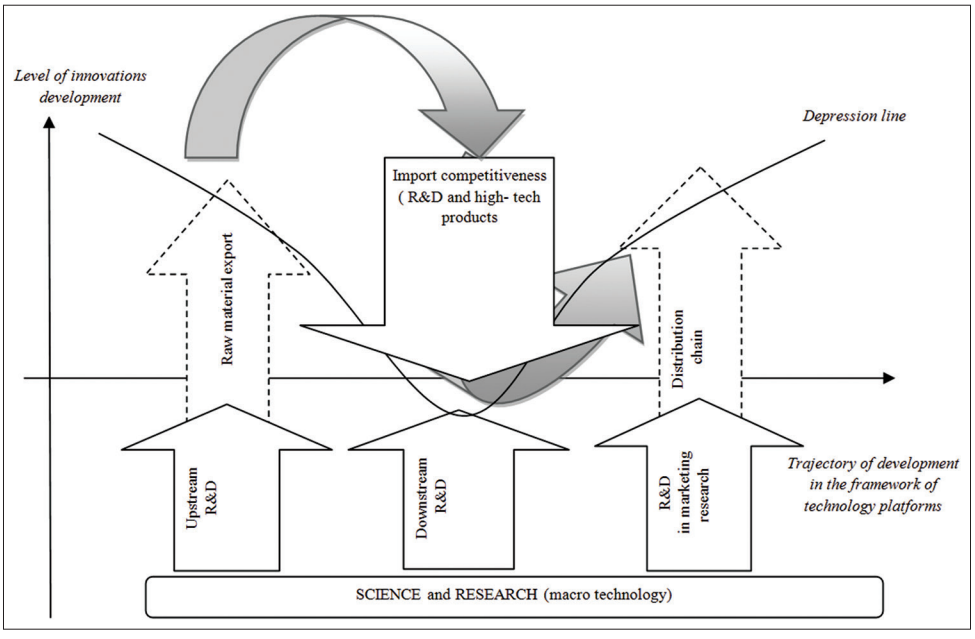
Comparing the levels of the innovations in such sectors of economy as producing, processing and marketing, we can observe availability of engineering in industries dealing with raw materials, because foreign companies are interested precisely in upstream flows, independent processing of raw material and new products (Figure 1).

R and D level in manufacturing sector of economy is low. It is depressing as a result of pressure exerted on the developers of innovations, obsolete technologies and import of high-tech products. This state of things prevents Russia from raising its status on the world stage. We propose to bring to minimum the high-tech import depressing, and improve the level of R and D, as well as the opportunities for its export in manufacturing industries with the use of a TP as an instrument in equalizing the innovation levels in various forms of economic activity. Macro technologies which make the core of a TP allow to integrate and combine the processes of production, processing and high-tech products sale, and after all, increase the level of competitiveness, enhance export capacities and overcome suppression of the Russian science by import.

In the contemporary world, economy innovations are the most significant means of increasing competitiveness. The new terms "low and high road of competitiveness" have been introduced in the report of the United Nations Industrial Development Organization. (Michael Porter uses the term "high road" when speaking of the type of an innovation-driven economy ("the economy of knowledge," "high road of competitiveness ability") (Porter, p165). "Low road" is based on attracting foreign investments as a response to have cheap labor and natural resources. The latter trend leads the erosion of innovative capacity.

At present, all the developed countries evolve according to "high road" scenario, whereas Russia is located at bifurcation point and, probably, its movement will tend to take a "low road" in the country development process. In addition, Subbotina emphasizes that Russia is forced to take this choice not because HR is insufficient but as a result of wrong decisions or ignorance of officials carried away by market reforms, and thus pushing the country on the "low road" to competitiveness. According to the results of the research made by INSEAD, in spite of the far-sighted government policy in the sphere of developing national economy, the gap in innovative development between Russia and developed countries has been increasing in recent years (Galimulina, 2014).

Figure 1: Depressing high-tech sectors in the engineering model of Russia (Galimulina, 2014)



To eliminate the chaos in the development of Russia's economy and reduce the gap in innovative development we believe it necessary to plot an alternative vector marking the development route across the TP (Figure 2). The latter may ensure reduction in the transaction expenses associated with shifting on to a "high road" of the country's economic development.

A vague definition for responsibility when making decisions related to considering a way out from the point of bifurcation, and interrelation of science and technology contribute to effective managing these tides. TP are capable of solving this problem. However, the quantitative evaluation of the instrument application is not quite clear, and this is caused by the complexity of the relationship being simulated.

3.3. Mathematical Economic Model of Developing Technological Platforms

The dynamic factor analysis (according to principal components method) revealed the system of factors necessary when investigating an object, and the ties between them have been interpreted:

- The inflows of technological innovations (acquisition of the new technologies by means of hiring new specialists, acquisition of new technologies in the form of rights to the patents, invention licenses, industrial samples, useful models, etc.).
- The innovation potential of enterprises (implementation of researches and developments, including equity financing, science intensity, transfer of the new technologies in the form of patents, invention licenses, industrial samples, useful models, etc.).
- An indicator of integration with knowledge-driven economy (collaboration with universities to implement research and developments, costs of personnel education and training).

On the basis of mathematical economic model, i.e., on the basis of the values of factor variables, the portion of each component in the total dispersion, and with the aim of quantitative assessment of TP, we suggest to use TP development indices for various types of economic activity. To calculate the integral index of TP development we suggest one of the methods used in calculating an integral indicator - the sum method:

$$U_{ТП_i} = \frac{\sum_{j=1}^{n} \sigma_j^2 \bullet E_{ij}}{100} \quad (1)$$

Where,

$U_{ТП_i}$ - Integral indicator of TP development,

i - Type of economic activity

j - Number of components

σ_j^2 - Total dispersion of j - component (%)

Eij - correlation index of i - type of economic activity versus j factor derived (values are obtained as a result of the factor analysis, SPSS Statistics software).

The index proposed reflects the total contribution of main components to the total performance score, i-type of economic activity. On the basis of this index we suggest a technique of revealing structural shifts within the framework of TP. Using aggregating data and the equation (1) we have calculated the values for the integral indices of TP development and identified their change after implementing TP into institutional environment of Russia's economy (Table 1).

On the basis of using integral indicators for developing the TP there were downstream branches ranged, and as a result 3 sub-groups of branches have been distinguished. The Interval Estimation method for each group means the following: The entire range of integral indices for 13 activity types selected could be classified into 3 groups with the approximately equal interval.

As a result, the following groups have been obtained:

- Group 3: Includes activities with low value of integral index $U_{ТП} \leq -0.3$.
- Group 2: The average value of integral indicator $-0.3 \leq U_{ТП} \leq 0.17$.
- Group 1: High value of integral indicator $U_{ТП} \geq 0.17$.

Group 1 covers sectors which are characterized by high integral indicator, i.e., those forms of economic activity that are capable of manifesting the highest activity when developing innovations. The highest value is characteristic for manufacturing motor vehicles, which confirms the arrangement of this branch in quadrant 1 in all cases examined above. The least active are organizations specializing in leather goods and woodworking.

The growing share of industry branches presented in group1 is the result of introducing TP into the instrument structure for innovation management in Russia. The list of TP that contributed to increase in the integral indicator value is presented in Table 2.

Figure 2: Institutional trajectory of technology platforms development (Galimulina, 2014)

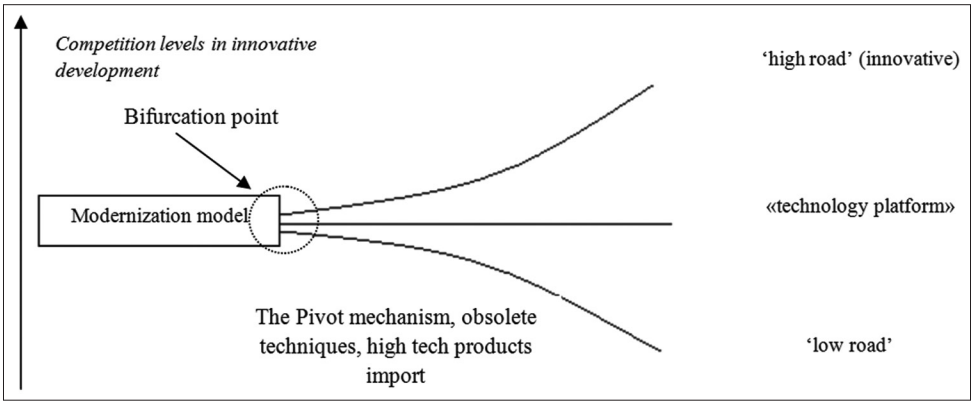


Table 1: Dynamics of the integral indicator for economic activity types following implementation of technology platforms

Economic activity type	Before implementation of technology platforms		After implementation of technology platforms	
	$U_{TП}$	Group	$U_{TП}$	Group
Leather and leather goods manufacturing	−0.78369	3	−0.36302	3
Woodworking and woodwork manufacturing	−0.32141	3	−0.71086	3
Non-metal mineral product manufacturing	−0.26634	2	−0.38895	3
Apparel and textile manufacturing	−0.2019	2	−0.22253	2
Food production (including beverages and tobacco)	−0.18703	2	0.133302	2
Pulp and paper production; the publishing and poligraphic activity	−0.18181	2	−0.44873	3
Plastics and rubber products manufacturing	−0.05431	2	−0.02876	2
Coke and refined petroleum products manufacturing	0.038131	2	0.233318	1
Chemical production	0.068816	2	0.228682	1
Metallurgical production and finished metal ware	0.231703	1	0.216711	1
Machinery and equipment manufacturing	0.480352	1	0.306278	1
Electrical equipment, electronic and optical equipment manufacturing	0.513806	1	0.536501	1
Motor vehicles and transportation equipment manufacturing	0.663689	1	0.508062	1

Table 2: Existing Russian TP and corresponding industry sectors

Industry sector	TP
Electrical equipment, electronic and optical equipment manufacturing	TP 25: Mechatronics, built in systems of management, radio-frequency identification and robotics engineering
Motor vehicles and transportation equipment manufacturing	TP 18: Innovations to increase efficiency in construction, maintenance and safety of the roads and railways TP 19: High speed railway intelligent transport
Machinery and equipment manufacturing	TP 26: Microwave techniques
Coke and refined petroleum products manufacturing	TP 24: Advanced processing of hydrocarbons
Chemical production	TP 2: Bio industry and bio resources – BIOTECH 2030
Metallurgical production and finished metalware	TP 20: New polymers and composite materials and techniques TP 21: Metallurgy materials and techniques

TP: Technology platforms

From 13 branches studied only 3 branches (chemical manufacturing, electrical equipment, electronic and optical equipment; coke and refined petroleum products manufacturing have demonstrated significant positive dynamics. This makes it possible to judge the effectiveness of the TP functioning in priority trends within the frameworks of corresponding industries.

This list may include such TP as "Photonika" and "Biotekh-2030." A rather weak positive dynamics is outlined in leather, leather goods and footwear manufacturing, food production (including beverages and tobacco), plastics and rubber products manufacturing, where the level of innovations is relatively low.

4. DISCUSSION

Michael Porter identified two options of economy development: "High road" - driven by innovations; and "low road" (using foreign investments) (Porter, 1990). Concurrently, the existing typology of development options does not consider an alternative, transitional form from "high" to "low" trajectory of development.

The TP principles are based on triple helix model. This model has been studied by a number of well-known scholars (Etzkowitz, 2002; Leydesdorff, 2005; Satinsky and Bouthot, 2011; Dezhina and Kiseleva, 2008; Smorodinskaya et al., 2012; Araslanova, 2011; Drobot et al., 2011; Shmatko, 2014; Shinkevich and Shinkevich, 2011; Druzhinina, 1991).

The works enlisted consider the exceptionally synergetic interaction of science, business and state, prevailing role of research and knowledge. Some other scientists devote their energies to solving the problem of the quantitative assessment of triple helix model effectiveness and, as a result, the mechanism of TP (Drobot et al., 2011; Teterkina et al., 2010).

However, none of the methods for assessing the results of interrelationship between research, business, and production (in the sphere of innovations) is adequate to the content of TP model that determines the necessity to create the integral procedure resulting from determined empirical dependences in Russian R and D, and further simulating on this basis.

5. CONCLUSION

As a result of the investigation performed, it has been revealed that the import of TP instrument into the Russia's economy provides slow, but positive results. The insufficient potential of TP hampers modernization process in Russia. It is necessary to develop mechanisms of government support of Russian's science.

First of all, this instrument is capable of solving the problem, urgent in Russia, concerning the point of bifurcation and effective research and technology management with reduction in transaction expenses. Due to effective functioning of TP the level of the innovation development of Russia's economy will potentially

grow and approach the level of developed countries, thus improve the status of the country in accordance with the global innovation index.

In this case, the TP, oriented to determine the priority trends in technological development of the country, may be able to minimize depressing by import of high-tech products and equalize the levels of innovation development of the various economic activities being investigated. Macro-technology provided from the scientific sector may serve as the foundation for equalizing the depressing line.

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