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THE TRIPLE HELIX MODEL IN THE RUSSIAN ECONOMY: THE QUALITY EVALUATION OF NEW INSTITUTIONALIZATION

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Abstract

This article analyzes the transition of the national economy to the Triple Helix model. This model is considered as new institutionalization. The evaluation has been carried out using the modified method of evaluation of innovation diffusion. It has shown that the Russian economy and especially the national entrepreneurship need additional incentives to direct economic, as well as social, sectors to the innovation-based development. The article clarifies the econometric methodology for assessing the rate of diffusion of innovations in national economies (the Rogers's model), which made it possible to study the dynamics of the development of the Russian economy from this point of view. The obtained data suggest that a qualitatively new economy based on the triple helix model by H. Etzkowitz has not yet been formed in Russia, which explains the current stagnation. The innovation reserve available in the Russian economy can be used for a technological breakthrough, but this will require new economic reforms.

Keywords

Triple Helix – Institutionalization – Innovations – Economy – Entrepreneurship
Diffusion Of Innovations

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Introduction

In one of the first publications by H. Etzkowitz and L. Leydesdorff[1] dedicated to studying the Triple Helix model, it is mentioned that since the 1990s, governments of many new industrial and highly developed countries have discovered that:

- First, economic and social changes based on knowledge determine the dynamics and intensity of the development of the economic and social sectors of a country;

- Second, these changes require the creation of special mechanisms, which will be terminal; this means that they will overcome the lack of institutional integration.

Certainly, there have been attempts to integrate economic, social, scientific and political dynamics before the research by H. Etzkowitz and his co-authors and after the publication of the results of their research (at present). One should note that the earliest works (by K. Marx, N.D. Kondratyev, J. Schumpeter, G. Freeman, S. Kuznets, E. Jantsch and others) had a differential approach to such important institutions as business (economy), authority (state) and science (university), which determine the evolutionary dynamics.

The work by D. Sabato and M. Mackenzie[2] and the work by A. Trak and M. Mackenzie[3] appeared almost at the same time (one year apart) in the 1980s. The first work studies the problem of technological transfer and technological dependence in the context of the influence of political processes on technology. The second work provides the definition of the national innovation system, which includes national institutional actors, business entities and other economic/social agents, the activities and cooperation of which are aimed at supporting and/or ensuring direct innovative activities. The institutional structural elements of national innovation systems were defined in line with the Triple Helix model (state, business and science/education). Thus, by the end of the second decade of the 21st century, people have understood clearly that:

a) Science and innovations drive the economy and the evolutionary progress in general;

b) Cognitive resources are the most precious resources for sustainable and ecologically responsible development;

c) Integration of efforts of the state, business and science for the creation of cognitive resources and their transformation into innovations provide a long-term positive synergistic effect.

[1] L. Leydesdorff & H. Etzkowitz, “The Triple Helix: University-Industry-Government Relations: A Laboratory for Knowledge Based Economic Development”, EASST Review, Vol: 14 num 1 (1995): 14-19 y L. Leydesdorff & H. Etzkowitz, “Emergence of a Triple Helix of "University – Industry – Government Relations", Science and Public Policy, Vol: 23 num 279 (1996).

[2] J. A. Sabato & M. Mackenzie, Technology and the productive structure. Instituto Latinoamericano de Estudios Transnacionales. 1979.

[3] A. Trak & M. Mackenzie, “Appropriate technology assessment: A note on policy considerations”, Technological Forecasting and Social Change, Vol: 17 num 4 (1980): 329-338.

Therefore, the Triple Helix model can be the most optimal scientific construct, which describes institutional cooperation between the actors (state, science/education and business) that are relatively autonomous and at the same time, enough closely connected.

Literature Review

In 2002, T. Shinn's article was published, where he analyzed and seriously criticized the works by H. Etzkowitz and L. Leydesdorff, as well as the authoring team of M. Gibbson[4]. According to T. Shinn, every approach has its strong and weak points, but these works are no more than, a fleeting idea which contributes to the development of science and practice[5]. Certainly, the idea of development based on knowledge is not critically new. Moreover, it has analogies in biology (for example, the biological evolution of the modern civilization is studied in the context of Triple Helix).

However, it cannot be denied that before the publication of works by the authoring team of M. Gibbson, as well as the publication of works by H. Etzkowitz, including those written in collaboration with L. Leydesdorff, many ideas (which are banal and obvious, according to critics) had not been not considered in the context of national hierarchy or hegemony of individual institutional actors with their dominant position in their usual environment. One should note that the Triple Helix model was formed in the general or global context, which means that:

- First, "the state of coercion" was transformed into "the social state" in many countries; not against but due to the active implementation of fundamental knowledge into the economy and social interaction;
- Second, the academic science with its strong (extremely strict) disciplinary and structural internal hierarchy has shown the tendency for transdisciplinarity (interdisciplinarity);
- Third, it is understood by the business that material resources and access to them (the ability to redistribute and use them) are important but core competencies are formed only if the company has cognitive resources.

Thus, the obvious external global context needed general institutional rethinking. H. Etzkowitz and L. Leydesdorff proposed the Triple Helix model at the beginning of the 1990s. More than 20 years have passed since the first publication of the scientific concept of the Triple Helix model. Not so long time ago this concept was mentioned as a fundamental interdisciplinary theory[6] and some authors continue to study the practical use of the Triple Helix model[7] in the national social and economic systems of countries with

[4] M. Gibbson, The New Production of Knowledge (London: SAGE Publication, 1994) y H. Nowotny; P. Scott & M. Gibbons, Re-Thinking Science: Mode 2 in Societal Context. 2001. Retrieved May 28, 2019 from: http://www.comparsociology.com/wp-content/uploads/2013/02/Mode2-Science-Gibbons-Nowotny.pdf.

[5] T. Shinn, "The Triple Helix and New Production of Knowledge. Prepackaged Thinking on Science and Technology", Social Studies of Science, Vol: 34 num 4 (2002): 15-19.

[6] E. Carayannis; T. D. Barth & D. Campbell, "The Quintuple Helix innovation model: global warming as a challenge and driver for innovation", Journal of Innovation and Entrepreneurship, Vol: 1 num 2 (2012) https://doi.org/10.1186/2192-5372-1-2 y R. Scholz & G. Steiner, "Transdisciplinarity at the crossroads", Sustainability Science, num 10 (2015): 521-526.

[7] M. N. Dudin; N. V. Lyasnikov & A. S. Senin, "The Triple Helix Model as an Effective Instrument for the Innovation Development of Industrial Enterprises within the National Economy", European researcher, Series A, Vol: 6 num 76 (2014): 1066-1074; M. N. Dudin; E. E. Frolova; N. V.

transition economies (Russia, China, Brazil, South Africa and some former Soviet countries, such as Moldova, Ukraine, Georgia and Armenia). It is important that many scientists and researchers believe that the national institutional environment is not in line with the Triple Helix model[8]. However, it is important to understand that:

- First, the Triple Helix model describes the principle and fundamental institutional interaction, which takes place in any national social and economic system;
- Second, the Triple Helix model is not a combination or a set of ready practical solutions, which will ensure a country's economic and technological leadership;
- Third, the Triple Helix model provides a basic idea of how to build strategic communications between institutional actors in an optimal way in order to obtain maximum social and economic effectiveness.

Thus, in this research, the Triple Helix model is studied in its theoretical reasoning as a scientific fundamental concept, which describes the sources, factors and results of the national social and economic, political and scientific dynamics in the most reliable way. It also indicates the characteristic patterns of changes in the dominant neo-institutional paradigm with due consideration of the global movement from the current wastefulness to the responsibility to the future. From the practical point of view, the Triple Helix model is a three-dimensional configuration, which shows that the changes in demand, supply and technological trend in national markets and in the global market are caused by systematic influence. This influence is a result of active interaction of the state, business and science.

Materials and Methods

This article studies and determines the principal applicability of the Triple Helix model based on epy content analysis of theoretical and methodological sources. These sources describe evolutionary changes in social, political, economic and technological processes, which occur in the national and world economy. The Triple Helix model is proposed as an institutional basis, which will ensure the innovative transformation of the national development model. The consolidation of basic theoretical theses, which are presented in the previous section of the article ("Literature review"), allows expressing a hypothesis that the optimal ratio of research intensity and science output in the national economy determines the sustainability of its development. This sustainability needs analytical justification; therefore, the economic and mathematical model is required which will help either to justify this hypothesis or reject it.

One should assume that the Triple Helix model is an institutional platform for the national innovative economic system; therefore, the successful transition from the traditional hierarchic interaction of the state, business and science to the partner

Gryzunova & E. B. Shuvalova, "The Triple Helix Model as a Mechanism for Partnership between the State, Business, and the Scientific-Educational Community in the Area of Organizing National Innovation Development", Asian Social Science, Vol: 1 num 1 (2015): 230-238 y M. N. Dudin; E. E. Frolova; N. V. Gryzunova & E. B. Shuvalova, "The Triple Helix Model as a Mechanism for Partnership between the State, Business, and the Scientific-Educational Community in the Area of Organizing National Innovation Development", Asian Social Science, Vol: 1 num 1 (2015): 230-238.

[8] Y. Cai, "Implementing the Triple Helix model in a non-Western context: an institutional logic perspective. Triple Helix", A Journal of University-Industry-Government Innovation and Entrepreneurship, Vol: 1 num 1 (2014). https://doi.org/10.1186/s40604-014-0001-2 y J.-Y. Kim & M. Lee, "Living with casinos: The triple-helix approach, innovative solutions, and big data", Technological Forecasting and Social Change, num 110 (2016): 33-41.

networking cooperation should increase innovative activity in the economic and social sectors (that is, the demand and supply of innovative goods, works and services should show a steady upward trend). This trend can show the effectiveness or the performance of the transition from industrialization to post-industrialization based on the Triple Helix model.

The innovation dynamics are usually evaluated based on the speed of diffusion of innovations with the use of two mathematical models: Roger's model[9] and Boswijk's model[10]. Rogers's model is used in this research as the methodological basis for the description of the innovation dynamics in the Russian economy. The base of Roger's model is presented below:

$$IN_d = v_{IN} * (1 - IN \div IN_m) \quad (1)$$

$$IN = IN_m * (1 + e^{1-vt})^{-1} \quad (2)$$

where:

IN_d – volume of diffusion of innovations;

v_{IN} – speed or rate of diffusion of innovations;

IN – current volume of innovations;
IN_m – maximum possible volume of innovations;

e – base of the natural logarithm;

l – time lag in the innovation process;

t – period or number of accounted years in analysis.

Several clarifications are provided below:

- First, in this case, the formula (2) or the logistic curve describe not the current, but the maximum possible volume of innovations (IN_m);
- Second, it is proposed to calculate the rates of diffusion of innovations (v) as a ratio of the difference between the volume of innovative activity of the current and previous periods and the volume of innovative activity of the current period;
- Third, it is proposed to define the level of innovative activity (IN) or the volume of innovations as identical to the volume of production and realization of innovative products;
- Fourth, it is proposed to account the time lag of the innovative process through the inverse ratio of the technological level of the national economy to the technological level of the economies of the most developed countries by comparing the shares of technologies of the fifth and sixth technological paradigms.

[9] E. M. Rogers, Diffusion of Innovations. Simon and Schuster. 2010.
[10] H. Boswijk & P. H. Franses, "On the Econometrics of the Bass Diffusion Model", Journal of Business & Economic Statistics, num 23 (2005): 255-268.

Thus, the effectiveness of the transition of the national economy to a new institutional platform based on the Triple Helix model should be assessed based on the estimation of the innovative activity, sales of innovative products and diffusing innovation reserve (IN_d). The innovative activity should be considered as actual production quantity; diffusing innovation reserves (IN_d) should be determined by the speed of innovation distribution and potential capacity of the economy (that is, its ability to absorb cognitive resources and transform them into a knowledge-intensive product).

Results and Discussion

The initial data, which is necessary for the evaluation of the innovation dynamics in the national economy, is presented in Table 1.

Year	Production of innovation products, billion RUB	Rate of diffusion of innovations	Time lag in the innovation process
2013	3,507.9	0.41	0.57
2014	3,580.0	0.27	0.53
2015	3,843.4	0.18	0.48
2016	4,364.3	0.02	0.44
2017	4,167.0	0.07	0.44

Table 1
Initial data for quality evaluation of the transition of the national economy to a new institutional platform
Source: Prepared by the authors based on Science and Innovations[11]

The data is collected from open sources and processed using special formulas; the results of the processing are demonstrated in Table 2.

Year	Current innovative activity, billion RUB	Maximum innovative activity, billion RUB	Diffusing innovation reserve	
			billion RUB	In % to innovative activity
2013	3,507.9	4,342.8	834.9	23.8
2014	3,580.0	4,088.4	508.4	14.2
2015	3,843.4	4,200.8	357.4	9.3
2016	4,364.3	4,407.9	43.6	1.0
2017	4,167.0	4,333.7	166.7	3.4

Table 2
Results of quality evaluation of transition of the national economy to a new institutional platform
Source: Estimations are conducted by the authors

The obtained results of the calculations show that:

- First, the innovation process of the national economy is not stable, so in 2013-2014, the diffusing reserve was significant, but by the beginning of 2016 this reserve had been almost depleted;

[11] Federal State Statistics Service, Available at: http://www.gks.ru/wps/wcm/science_and_innovations/science/#

- Second, the capacities of the national economy to develop and transform cognitive resources into a knowledge-intensive product are gradually decreasing, even though technological effectiveness of the national economy is increasing; this shows that innovation processes are slowing down.

If the innovation process in the Russian economy was characterized by a steady upward dynamics and a steady increasing technological effectiveness, by comparing two curves (Table 3, Figure 1) with an exponential trend it would be possible to prove that in Russia, a new quality of the institutional field has not yet been formed.

Year	urrent innovative activity, billion RUB	Maximum innovative activity, billion RUB	Diffusing innovation reserve	
			billion RUB	In % to innovative activity
2013	3,507.9	3,606.1	98.2	2.8
2014	3,580.0	3,712.5	132.5	3.7
2015	3,843.4	4,043.3	199.9	5.2
2016	4,364.3	4,656.7	292.4	6.7
2017	4,167.0	4,487.9	320.9	7.7

Table 3
Results of hypothetic quality evaluation of the transition of the national economy to a new institutional platform
Source: Estimations are conducted by the authors

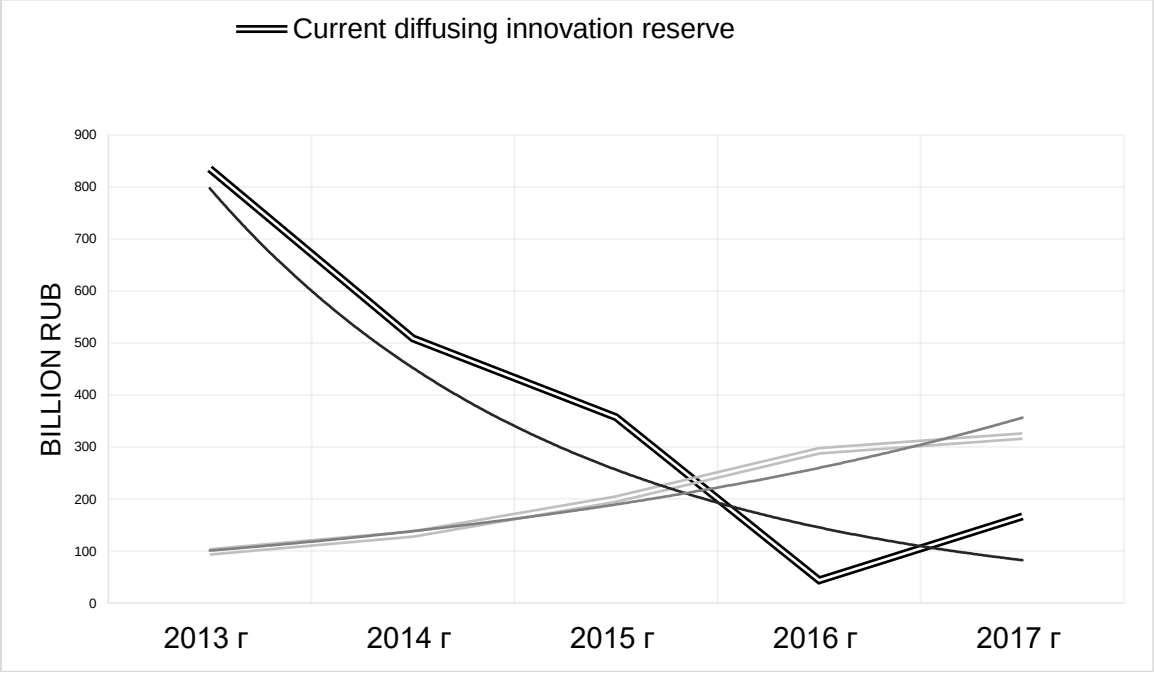

Figure 1
The trend of current and hypothetically possible innovation reserve in the national economy
Source: Prepared by the authors based on the data presented in Table 2 and Table 3

There are several objective and subjective reasons for this:

1) The objective reasons include not only the dependence of the national economy on resources and the necessity to modernize the material and technical base and technological base of many industries of the real economic sector but also the geopolitical confrontation of Russia with some developed countries. This confrontation causes social and economic instability, capital outflow and decrease of investment attractiveness of the national economy;

2) Objective reasons also include historically weak connections between the business and scientific-educational spheres, even though the state is actively financing creation and development of the innovation infrastructure, including scientific and production clusters, special economic zones, business incubators, innovation centers, etc.;

3) Subjective reasons are more numerous than objective reasons. The main one is that Russian entrepreneurs do not want and do not strive to carry out innovation-oriented and knowledge-intensive activities. The state statistics prove this supposition. For example, 50-60% of all operating enterprises on average carry out their activities in retail and wholesale trade (without the innovation component). Most of the newly established organizations operate in this sphere.

Thus, an objective exists to find counter solutions. The state should initiate and finance the development of innovation infrastructure. Entrepreneurs and the scientific-educational sector should strive to operate it for creation of new technologies, knowledge-intensive kinds of economic and non-commercial activities and to increase the production of competitive innovative products requested by the domestic and foreign markets. The problem of Russian economy developing under total state paternalism and protectionism has a negative impact on the encouragement of innovation-oriented entrepreneurship but it is not the only problem.

A more significant negative factor is the lack of internal motivation to carry out knowledge-intensive and high-technology activities. Certainly, there are high entry barriers to high-technology segments of markets. One should note that:

- Russian society remains patriarchal; the main infrastructure for innovation is concentrated in the central regions. Therefore, the demand for high-tech products, as well as services, is the highest in highly urbanized areas;
- The legislative and executive authorities are lobbying for the economic interests of business entities. However, only the interests of large and extra large businesses are mainly lobbied, while the interests of small and medium businesses are considered and presented least of all.

Certainly, a low intellectual and cognitive potential leads to a negative impact on the internal motivation of entrepreneurs for knowledge-intensive activity. This potential is the basis for the entrepreneurial capacity, which is a very important factor of production.

Conclusion

On the one hand, all necessary conditions for the transition of the Russian economy to a new institutional platform based on the Triple Helix model have been created. On the other hand, this transition cannot be completed until all factors, which have a negative impact on the entrepreneurial activity, and the barriers reducing the motivation of entrepreneurs for knowledge-intensive activity are eliminated. It is necessary

to understand that economic measures (such as grants, subsidies and fiscal preferences) do not have a long-term effect; they just create an immediate incentive. Moreover, one should note that non-economic measures (infrastructure, image and information support) create steady motivation and show their long-term deferred effectiveness.

In this research, we just touched on the issues of entrepreneurial motivation and the incentives used for increasing innovative activity. In our future research, we plan to study the key actions and methods of stimulating innovative, highly technological and venture entrepreneurship under new institutional conditions of cooperation of the state, business and the scientific-educational sector.

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