The European Proceedings of
Social & Behavioural Sciences
EpSBS

ISSN: 2357-1330

https://doi.org/10.15405/epsbs.2019.12.04.151

SCTCMG 2019

International Scientific Conference «Social and Cultural Transformations in the Context of Modern Globalism»

INSTITUTIONS AND INSTITUTIONAL ENVIRONMENT IN THE SCENARIO FORECASTING OF RESEARCH POTENTIAL DEVELOPMENT

Dmitriy Gorin (a)*
*Corresponding author

(a) Plekhanov Russian University of Economics, 28, Stremyanny Lane, 117997, Moscow, Russia
dm.gorin@mail.ru, +7-495-958-23-27

Abstract

The article studies the influence of institutions and institutional environment on the development of science and innovations in terms of the scenario forecasting of the development of Russian research potential. The scenario forecasting allows identifying possibilities of management influence on factors of the forecast background. Four main scenarios for the development of scientific potential were studied. The content of each scenario is determined in the space of opportunities which is determined by two axes of orientation reflecting dynamic characteristics of basic institutions and institutional environment. The first axis reflects contradiction between the orientation on innovative development and the influence of inertial dynamics. The second axis is the antinomy between “openness” and “closeness” associated with the influence of globalization processes and the current international situation on the development of cooperation in science and innovation areas. The scenario is predicted based on an expert survey in two rounds. In the first round, the most significant indicators reflecting the influence of institutions on the development of scientific potential, including government policy, economic development, ternational cooperation, human capital, the state of education, dominant values, etc. were determined. On the basis of expert estimates obtained in the second round, possible variants of the influence of institutional factors on the likelihood of each scenario were identified. Transition to the scenarios involving the development of scientific potential requires institutional conditions that stimulate the development of science and the innovation sector of the economy, the development of mutually beneficial international cooperation in the field of high technologies.

Keywords: Scientific potential, scenario forecasting, institutions, globalization.

https://doi.org/10.15405/epsbs.2019.12.04.151
Corresponding Author: Dmitriy Gorin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

The scientific potential is determined by opportunities, means and resources that society provides for implementing research projects. These are social infrastructure, dominant values and ways of thinking, the level of economic development, the state of human resources, the quality of human capital and the education system, science support from the government, business and civil society. On the one hand, value orientations, formal and informal norms affect professional activities of the researcher. On the other hand, basic institutions can contribute to or hinder the accumulation of human, social and cultural capital. In modern societies, the role of government and science policies in stimulating scientific research is increasing. At the same time, the role of the business sector is growing; its share in Germany, Denmark, Korea, and the United States accounts for more than 60% of all expenditures on science; in Japan, Switzerland and Sweden – 70%, while in Russia this share is only about 30% (Gokhberg, Zaichenko, Kitova, & Kuznetsova, 2011). The educational system and creative environment (Yang, Hong, Lee, & Lin, 2019), teamwork (Yu, Dino, Lee, & Xia, 2019), transfer of norms of the scientific ethos and sanctions for improper behavior of the researcher (Hussinger & Pellens, 2019) play a significant role in developing science. The influence of external factors consists not only in imposing restrictions and providing opportunities for the scientific community, but disseminating scientific discourse which goes beyond the narrow professional environment. The dominant norms and values influence scientific positions and intellectual movements (Rolin, 2016). Discussion of research results is subject to public expectations and stereotypes (Alexander, 1992) correlated with public discourses (Klamer, 1988). Therefore, institutional factors, including values and discursive aspects reflecting formal and informal norms of regulation of research activities and innovations require specification in order to determine the nature of their impact on the development of the scientific potential.

2. Problem Statement

One of the main issues of research on the development of science and innovation is the impact of public institutions and the institutional environment on scientific potential development. It is necessary to make strategic decisions. The scenario analysis is a way to conceptualize strategic decisions (Meissner & Wulf, 2013). The scenario forecasting makes it possible to identify the management influence on the forecast background in order to minimize the likelihood of undesirable development and maximize the likelihood of acceptable scenarios. The scenario forecasting (Wright, Bradfield, & Cairns, 2013; Blagoveshchensky, Krechetova, & Satarov, 2012) and scientific and technological development forecasting (Kuzyk & Yakovets, 2004; Mindeli, Ostanyuk, & Chernykh, 2017) methods have been studied. The role of institutional factors in social development, including basic institutions and the institutional environment, is being studied. At the same time, methodological issues of institutional factors in the scenario forecasting of scientific potential development are understudied.

3. Research Questions

The research subject is the impact of institutions and the institutional environment on scientific potential development in modern Russia. Variability of scientific potential reproduction is reflected in basic

https://doi.org/10.15405/epsbs.2019.12.04.151
Corresponding Author: Dmitriy Gorin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

scenarios of its development. The probability of the scenario correlates with the variable manifestation of institutional factors of the forecast background. The relationship between probability scenarios and events that determine the factors of the predicted background was identified on the basis of expert assessments.

4. Purpose of the Study

The study aims to identify probable scenarios for scientific potential development and dependence of their probabilities on the basic institutions of society and the institutional environment expressed in formal and informal norms and value orientations.

5. Research Methods

The scenario analysis aims to describe a holistic and variable picture of the probable future in the context of interrelation of determinants. Assessment of the likelihood of certain events and identification of the most probable scenario is less significant than analyzing the nature of the influence of the predicted background factors on scientific potential reproduction. The scenario forecasting model parameters were specified on the basis of expert estimates obtained during expert survey conducted in two rounds using a questionnaire method (29 experts were surveyed). When evaluating various parameters of the forecast model (scenarios, forecast background factors, possible events determining the impact of these factors on the scenarios of scientific potential reproduction), experts were asked to proceed from a ten-year lead-up period (until 2030).

6. Findings

The scenarios of scientific potential reproduction are results of understanding variability of this process in the space of possibilities defined by two axes reflecting possible options for institutional transformations.

The first axis reflects the alternative between innovative and inertial development. The need for innovative development of modern science and technology is obvious, but under certain conditions, production and diffusion of innovations will be blocked by unfavorable institutional conditions, contributing to the inertial or imitation reproduction of the scientific potential.

The antinomy between openness and closeness was chosen as the second axis. This choice is due to the fact that the development of scientific potential is a significant and ambiguous impact of globalization and international cooperation. On the one hand, international cooperation allows researchers to gain remote access to scientific tools and contributes to the scientific research (Sonnenwald & Li, 2003); on the other hand, global competition may lead to the degradation of uncompetitive regional scientific schools. The public policy can focus on integration into global processes or isolation.

Both axes reflect the variability of forecast background factors and determine the space of variation of the scenarios of reproduction of the scientific potential. Scenarios are a model description of possible options for the reproduction of scientific potential in a period determined by the forecast horizon. The scenario reflects one of the development trends which can determine the projected future state of the

https://doi.org/10.15405/epsbs.2019.12.04.151
Corresponding Author: Dmitriy Gorin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

scientific potential. For expert assessments, four basic scenarios were formulated, each of which is determined in the antinomic terminology of the axes mentioned above.

Scenario 1. Global competition.

Development of the scientific potential based on modernization of science and education and stimulation of development of the most promising areas that can become competitive on a global scale.

The main characteristics are as follows:

- elimination of the inertia and provision of incentives for innovative development;

- development of international cooperation with global research centers and integration into global technological chains.

Scenario 2. Inertial reproduction.

The gradual extinction of the scientific potential caused by the inertia of its gradual disintegration in the face of declining funding for fundamental branches of knowledge and managerial dysfunctions, including the replacement of the real content of scientific activities with formal indicators.

The main characteristics are as follows:

- inertial inhibition of production and dissemination of innovations;

- openness to international cooperation and integration into global technological chains.

Scenario 3. Imitation of innovative development.

The tightening of requirements for the scientific community expressed in formal indicators reflecting artificial stimulation of the innovative development of the scientific potential.

Main characteristics are as follows:

- simulation of production and distribution of innovations;

- relative international isolation.

Scenario 4. Mobilization breakthrough.

The mobilization development of scientific potential on the basis of modernization of science and education contributing to global competition in conditions of relative international isolation.

The main characteristics are as follows:

- elimination of the inertia and provision of incentives for innovative development based on mobilization modernization of scientific potential reproduction;

- relative international isolation.

The next component of the forecast model is forecast background factors reflecting the impact of basic institutions and institutional environment. These factors are political, socio-economic, educational and mental environments. The list of factors was reduced to eleven most significant factors. Variability of their actions is operationalized by describing a set of possible events that determine the nature of the influence of each factor on the reproduction of scientific potential. The sets of events are combined with each of the factors, and various events can be combined with each other increasing or decreasing the likelihood of a particular scenario. The set of events was also specified in the first round of the expert survey. In the second round of the expert survey, estimates of the probability of events were given (Table 01).

https://doi.org/10.15405/epsbs.2019.12.04.151
Corresponding Author: Dmitriy Gorin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

Table 01. Expert assessments of prediction of t probability of events specifying the nature of impacts of prediction background factors on reproduction of the scientific potential

Predictive background factors	**Events**	**Expert assessment of probability of events**
1. Public funding of science and education	1.1. Government funding is increasing	5%
	1.2. Government funding is not increasing significantly	42%
	1.3. Government funding remains at the same level.	46%
	1.4. Government funding is decreasing	7%
2. International sanctions (access to global technological chains and global markets)	2.1. Sanctions are gradually being eliminated	15%
	2.2. Sanctions remain at the current level or are being weakened / tightened	73%
	2.3. Sanctions are being significantly tightened	12%
3. International relations	3.1. Intensity of international relations is decreasing, prospects for international cooperation are occuring	23%
	3.2. The tension of international relations remains at the existing level which hinders the development of international cooperation	62%
	3.3. International tensions are increasing reducing international cooperation.	15%
4. The needs of the MIC	4.1. The needs of the military industrial complex are increasing which increases research funding	18%
	4.2. The needs of the military-industrial complex are increasing, but this does not increase research funding	32%
	4.3. The needs of the MIC remain at the existing level	45%
	4.4. The share of the military industrial complex in the national economy is decreasing	5%
5. Private investment in science and education	5.1. The development of the private sector is increasing private investment in science and education.	9%
	5.2. Private investment in science and education is at the current level.	74%
	5.3. Private investment in science and education is decreasing.	17%
6. The state of the innovation sector of the economy	6.1. The innovative sector of the economy is growing	38%
	6.2. The innovative sector of the economy is in stagnation	47%
	6.3. The innovative sector of the economy is declining	15%
7. Needs for development of the green economy and renewable energy sources	7.1. The government is taking measures aimed at improving the environmental situation and reforming the energy sector in order to abandon the hydrocarbon energy and use renewable energy sources.	10%
	7.2. The government is taking measures aimed at improving the environmental situation, however, it is not taking significant measures aimed at moving to the “green economy”	67%

https://doi.org/10.15405/epsbs.2019.12.04.151
Corresponding Author: Dmitriy Gorin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

	7.3. The government does not take measures to improve the environmental situation, move to the "green economy" and use renewable energy sources.	23%
8. The state of human capital	8.1. The state of human capital is improving	28%
	8.2. The state of human capital remains at the current level	47%
	8.3. The state of human capital is deteriorating	25%
9. The quality of education	9.1. Measures aimed at increasing the quality of education are being implemented	24%
	9.2. The quality of education remains at the current level.	46%
	9.3. The quality of education is deteriorating	30%
10. Social dominance of survival or self-expression values.	10.1. Socio-political situation and the mass media contribute to the self-expression values	22%
	10.2. The ratio of survival and self-expression values is preserved	62%
	10.3. Increasing socio-political tensions and political propaganda contribute to the survival values and block the self-expression values	16%
11. Migration of researchers ("brain drain")	11.1. "Brain drain" stops, researchers return to work in their country	4%
	11.2. "Brain drain" is maintained at the current level	81%
	11.3. Brain drain is increasing	15%

In order to specify basic scenarios of the reproduction of scientific potential and their relationships with the factors of the predicted background, another component of the scenario forecasting model was introduced. It is a description of the model relationships of probable events with one or another basic scenario. This link was specified in the first round of the expert survey (Table 02).

Table 02. Scenarios of reproduction of the scientific potential of a modern researcher and events specifying the nature of prediction background factors

SCENARIO 1. Global competition	**SCENARIO 2. Inertial reproduction**	**SCENARIO 3. Imitation of innovative development**	**SCENARIO 4. Mobilization breakthrough**
Factor 1. Public financing of science and education			
Event 1.1. Event 1.2.	Event 1.2. Event 1.3. Event 1.4.	Event 1.2. Event 1.3. Event 1.4.	Event 1.1.
Factor 2. International sanctions (access to global technological chains and global markets)			
Event 2.1.	Event 2.1. Event 2.2.	Event 2.2. Event 2.3.	Event 2.2. Event 2.3.
Factor 3. International Relations			
Event 3.1.	Event 3.1. Event 3.2.	Event 3.2. Event 3.3.	Event 3.3. Event 3.2.
Factor 4. The needs of the MIC			
Event 4.1. Event 4.3. Event 4.4.	Event 4.2. Event 4.3. Event 4.4.	Event 4.2. Event 4.3. Event 4.4.	Event 4.1.
Factor 5. Private investment in science and education			
Event 5.1.	Event 5.2.	Event 5.2.	Event 5.2.

https://doi.org/10.15405/epsbs.2019.12.04.151
Corresponding Author: Dmitriy Gorin
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

	Event 5.3.	Event 5.3.	Event 5.3.
Factor 6. The state of the innovation sector of the economy			
Event 6.1.	Event 6.2. Event 6.3.	Event 6.2. Event 6.3.	Event 6.1.
Factor 7. The need for development of "green economy" and renewable energy sources			
Event 7.1.	Event 7.2. Event 7.3.	Event 7.2. Event 7.3.	Event 7.2. Event 7.3.
Factor 8. The state of human capital			
Event 8.1.	Event 8.2. Event 8.3.	Event 8.2. Event 8.3.	Event 8.1. Event 8.2.
Factor 9. The quality of education			
Event 9.1.	Event 9.2. Event 9.3.	Event 9.2. Event 9.3.	Event 9.1.
Factor 10. Dominance of survival and self-expression values			
Event 10.1.	Event 10.2. Event 10.3.	Event 10.2. Event 10.3.	Event 10.3.
Factor 11. Migration of researchers ("brain drain")			
Event 11.1. Event 11.2.	Event 11.2. Event 11.3.	Event 11.2. Event 11.3.	Event 11.2. Event 11.3.

Based on the expert assessments and previously identified model relationships between the dynamics of scientific potential development and institutional factors, the probability of implementing the basic scenarios was calculated. The probability of the implementation of the "Global competition" scenario was 19%, the "Inertial reproduction" scenario - 37%; the "Imitation of innovative development" scenario - 33%; the "Mobilization Breakthrough" scenario - 11%.

7. Conclusion

Development of science and innovations requires comprehensive solutions that take into account basic institutions and the institutional environment. Development of scientific potential requires social-institutional and value-normative incentives for innovative development. The transition to the scenarios involving innovative development of scientific potential can be based on institutional conditions that contribute to the development of research and innovation sectors of the economy, as well as mutually beneficial international cooperation in the field of high technologies. The probability of overcoming the inertial reproduction of scientific potential remains high in the medium term.

References

Alexander, J. (1992). *The Promise of a Cultural Sociology: Technological Discourse and the Sacred and Profane Information Machine. Theory of Culture*. Berkeley: University of California Press.

Blagoveshchensky, Yu. N., Krechetova, M. Yu., & Satarov, G. A. (2012). Expert-statistical Bayesian approach to political forecasting. *Political studies, 4*(130), 74–98.

Gokhberg, L. M., Zaichenko, S. A., Kitova, G. A., & Kuznetsova, T. E. (2011). *Science policy: global context and Russian practice*. Moscow: HSE.

Hussinger, K., & Pellens, M. (2019). Guilt by association: How scientific misconduct harms prior collaborators. *Research Policy*, *48*(2), 516–530.

Klamer, A. (1988). Economics as Discours. *The Popperian Legacy in Economics.* Cambridge: Cambridge University Press.

Kuzyk, B. N., & Yakovets, Yu. V. (2004). *Russia-2050: an innovative breakthrough strategy.* Moscow: Economy.

Meissner, Ph., & Wulf, T. (2013). Cognitive benefits of scenario planning: Its impact on biases and decision quality. *Technological Forecasting and Social Change, 80*(4), 801–814.

Mindeli, L., Ostanyuk, S., & Chernykh, S. (2017). Long-term forecasting of the development of fundamental science in Russia: methodological aspects. *Society and the economy, 10*, 8–9.

Rolin, K. (2016). Values, standpoints, and scientific/intellectual movements. *Studies in History and Philosophy of Science, part A, 56,* 11–19.

Sonnenwald, D. H., & Li, B. (2003). Scientific collaboratories in higher education: Exploring learning style preferences and perceptions of technology. *British Journal of Educational Technology, 34*(3), 419–431.

Wright, G., Bradfield, R., & Cairns, G. (2013). Does the intuitive logics method – and its recent enhancements – produce "effective" scenarios? *Technological Forecasting and Social Change, 80*(4), 631–642.

Yang, K.-K., Hong, Z.-R., Lee, L., & Lin, H.-S. (2019). Exploring the significant predictors of convergent and divergent scientific creativities. *Thinking Skills and Creativity, 31,* 252–261.

Yu, Sh., Dino, B. H., Lee, I., & Xia, F. (2019) Survey Science of Scientific Team Science: A survey. *Computer Science Review, 31,* 72–83.