RES MILITARIS
REVUE EUROPEENNE D ETUDES EUROPEAN JOURNAL OF MILITARY STUDIES
Social Science Journal

Scientific And Technological Potential Of The Socio-Economic Environment As A Tool For Ensuring Global Competitiveness In The Conditions Of The Sixth Technological Mode

By

Marat Rashitovich Safiullin
Kazan Federal University

Marat Rinatovich Gafarov
Center of Advanced Economic Research in the Academy of Sciences of the Republic of Tatarstan, Kazan Federal University

Leonid Alekseevich Elshin
Center of Advanced Economic Research in the Academy of Sciences of the Republic of TatarstanLeonid, Kazan Federal University
Tel.: +79872970679
Email: Elshin@tatar.ru

Abstract

The prospects for competitive economic development, both national and regional, are determined by the sustainability and adaptability to the transformations of institutional (fundamental) and conjunctural level. The most important category and mechanism of integration of economic systems into the process of ongoing systemic transformation is the degree of receptivity of territories to this kind of transformation, based mainly on the effectiveness of the processes of scientific and technological development (STD). This is due to the fact that it is the research potential and scientific connectedness of the economic and scientific-technological environment that are the main catalysts for the integration of the economy into the global agenda, and, therefore, the most important key to successful development in terms of inclusion into the current and future technological environment.

This paper is devoted to understanding and substantiating that position. Through a review and systematization of the great challenges generated in the sixth technological mode, it presents the author's position on the need to prioritize scientific and technological development as a key mechanism of economic growth in the modern knowledge economy.

Key words: science and technology development, scientific connectivity, big challenges, sustainability of development, sixth technological mode, global competitiveness.

Introduction

It is important to note that the definition of strategic directions of scientific and technological development at both the meso- and macrolevel should be determined, first of all, by fundamental factors that reveal the features of the formation of innovation and modernization waves that set the impetus for innovation development. Thus, according to N. Kondratiev's theory of long-term cycles [1] and J. Schumpeter's theory [2], innovation and the technological solutions and products they generate are the key triggers of technological stage

change. In this regard, the understanding and identification of productive factors corresponding to a particular technological stage determines not only the current understanding of the features of socio-economic development, but also expands the framework of the strategic vision of future transformations. Not only the sustainability of regional or national economies depends on how well they adapt to them, but also their global competitiveness on the scale of the new technological agenda.

In view of the above, the identification of such progressive productive factors and the search for mechanisms to integrate socio-economic systems into a new development paradigm within the ongoing phase shift of the long-term cycle become an extremely important task.

Based on the outlined concept of research into the directions and tools for stimulating scientific and technological development of territories in accordance with the ongoing fundamental transformations of technological environment, it is important to understand what forces and factors will determine our future, how socio-economic systems are adapted to the future transformations, to what extent they can integrate into new, emerging growth "points" from the position of adaptability of their infrastructure capacity, quality formation, and the development of the economy. In other words, it is extremely important to understand the essence of current and future technological patterns which will determine the parameters and framework of competitive development of territorial systems at both macro- and meso-levels.

Methods

The methodological basis for the study to reveal the specifics of the impact of scientific and technological potential of the socio-economic system on its global competitiveness is the study of the essence of macroeconomic generation and the factors that set the momentum for economic growth in conditions of technological shifts. In this regard, it is extremely important to understand the essence of these evolutionary processes that form the basis for future socio-economic development in the new, transforming conditions.

Each new macrogeneration is based on a cluster of innovations that conquer the market by offering new products, technologies and forms of production organization [3]. The aggregates of such macrogenerations form technological modes. Currently, there are six technological stages replacing each other during the period from 1760 to 2020.

It should be noted that macrogenerations can move from early technological modes to subsequent ones, thus forming the backbone structures of socio-economic development, in fact, setting the general vector of technological and economic progress. The longer such structures turn out to be, the more influence they have on what will be included as the technological basis of the subsequent technological mode, and what will be considered inappropriate for further development [4].

In accordance with the generally accepted approach, the category "technological mode" is "holistic production and technological systems that include technological processes of the corresponding type of economic activity, sectoral orientation, as well as elements and subsystems of various integrated (combined) into inter-industry clusters of complexes". [5].

In economic theory, a technological mode is usually understood as "a set of basic sets of technologically related productions" [6]. The technological mode itself "...is formed within the economic system, covering all stages of resource processing and the corresponding type of

non-productive consumption, forming a macroeconomic reproduction loop, a self-reproducing integrity...". [7].

If we consider the genesis of technological modes and corresponding productive factors ("basic technologies dominating in various periods of industrial and post-industrial development" [8]), which set impulses for intensive and competitive development of economic systems, we can identify six technological modes of society development [9, 10] (Figure 1). All of them are a reflection of organizational, managerial and scientific-technological development

It is important to note that these chronological frameworks are very tentative and are formed on the basis of N. Kondratiev's theory of long waves and their life cycle. According to the theory of long-term economic cycles, the change of phase shifts and transition of one cycle to another are based on scientific and production transformations formed within the framework of the change of technological modes. For example, at the fourth technological stage, the dominant production technologies were nuclear power, the invention and production of internal combustion engines, etc. The fifth cycle was based on the development of electronics, digital technologies, Internet, etc. The sixth technological cycle is based on super-digital technological solutions, high-precision medicine, nanotechnology, digital platforms combining a wide range of regional, national and global actors, etc. At the same time, agreeing with the position of S.Y. Glazyev [7], in the knowledge-based economy, the evolution of long waves can take place significantly outside the paradigm of the theory of long-term cycles, the main driver of which were innovation impulses and related new technologies transforming the so-called technological systems and organizational and production processes. This is primarily due to a noticeable reduction in the time frame in the chain "invention-mass production" [11, 12]. In addition, the correction of the "framework" of long waves is due to the violation of the periodicity of economic cycles of short- and medium-term periods, including due to the so-called shock impulses caused by conjunctural shifts in the system of international economic relations (for example, the sanctions confrontation, which violates the logic and natural course of the phase cyclical shifts in the economy).

Results and discussion

The most important factor, along with those presented above, influencing the correction of long waves in post-industrial economy is also the correction of "integrating systems". At the same time, its key element is "scientific connectedness", which should be understood as strategic schemes and innovation points of economic growth in the post-industrial environment based on the integration of economic and scientific and technological environment, which forms various models of scientific and technological development, defining the "core" of the technological mode. "Scientific connectedness" arises as a result of intensively generated scientific results, new developments in various spheres of social and economic life under the pressure of actively progressing technological solutions and knowledge. At the same time, "islands of new technologies and developments" can be actively generated in different spheres and may not be connected at certain points in time. However, under the pressure of the "scientific connectedness" effect, these islets are united by connections forming a new system and principles of economic development that are more progressive and set new impulses for scientific and technological development and organization of production cycles.

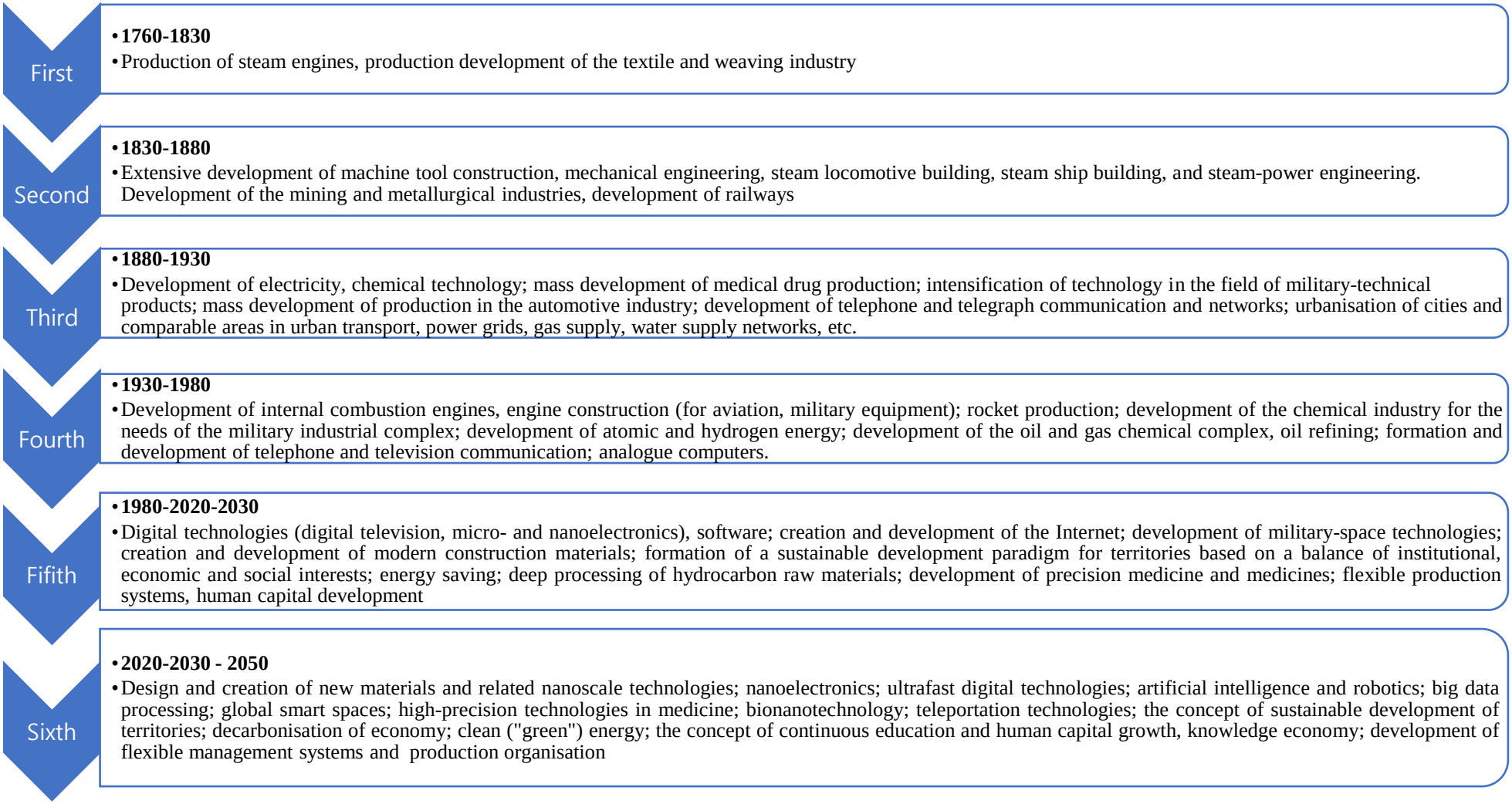

Figure 1 - Evolution of technological patterns and integrating productive technologies

As a result, the speed of development of economic systems and their structural transformations increases manifold relative to the industrial scheme of development, where the main element of the "integrating system" is the organizational elements of building production chains and cycles. In addition, there is every reason to believe that in the type of economic relations under consideration, the most important characteristic of the core of the technological pattern is sectoral spheres [13, 14]. At the same time, within the framework of post-industrial development (the fifth and sixth technological modes), the key elements of technological modes are not industries, not the reproductive circuit, but the "scientific-production", defined by scientific connectivity, the resulting generation of innovation, innovation niches, technologies and means of solving technological problems (for example, based on the use of artificial intelligence), new technologies, etc.

Thus, in post-industrial society, which is characterized by knowledge economy, the key growth driver is "scientific connectivity", which generates new forms of interaction and progress, "crystallization" of innovation chains and new niches of value added creation, which largely accelerates social and economic growth and thereby corrects the evolution of long waves.

Russia, like developed countries, is on the crest of the sixth technological mode, and the success of economic and competitive development of the country and its regions will be largely determined by integration of the structural components of the mode into the system of social and economic relations, principles of state and corporate governance and regulation of social relations at the interregional and international level. At the same time, the key components of productive factors of the new, sixth technological mode, which is actively developing in the world, should include:

- Ultrafast digital communications;
- Global information and intelligence networks;
- Development of military-space technologies;
- New structural, synthetic materials;
- Creation of innovative technologies on nano- and microlevel;
- Medical high-precision technologies;
- Creation of clean energy technologies;
- New educational digital technologies;
- Flexible manufacturing systems, robotics;
- Artificial Intelligence;
- Modern management technologies;

etc. [15]

It is important to emphasize that the level of scientific potential that enables the creation and replication of promising technological solutions will largely determine the prospects of adaptation of RF subjects to basic technological shifts and form windows of opportunity within the emerging challenges on the scale of global and national socio-economic systems.

The key role in this matter should be played by fundamental science, which provides new knowledge and relies on its own logic and development potential. Support of fundamental science as a backbone institution for sustainable and competitive growth of the economy and social sphere is a priority task for all constituent entities of the Russian Federation (Figure 2)).

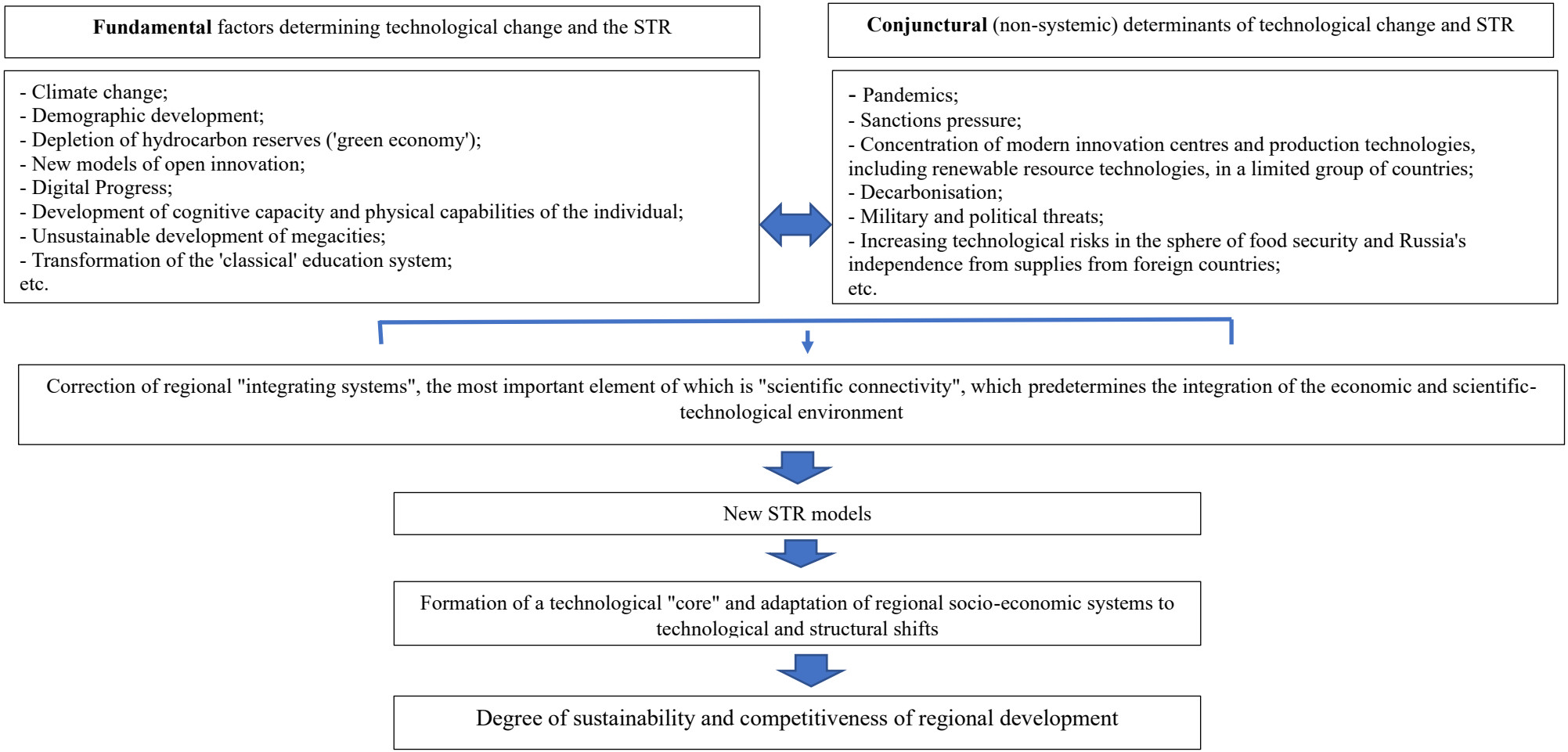

Figure 2 - Scientific connectivity of the socio-economic environment of a region as a tool to ensure its competitive development in the new technological environment

Summary

Based on the implemented approach, it should be noted that it is necessary to intensify the processes of building up the Russian Federation's scientific and technological potential in the conditions of the sixth technological mode, which is gaining momentum. The low level of funding for science in the Russian Federation results in very modest, relative to developed countries, indicators of such important indicators of STR efficiency as publication activity, weak innovation activity of the real sector of the economy, rhythmic reduction in the number of personnel engaged in research and development, and insufficient level of innovation activity.

These trends significantly limit the potential of socio-economic development and, in the medium and long term, form the risks of intensive development of the state [16]. This is due not only to the possible technological lagging behind the processes taking place in the global economy in the transition to the sixth technological mode, but also to the resulting limitations in the structural transformation of the national economy in the context of exhausting the opportunities of the extractive (focused on the export of hydrocarbon raw materials, mainly low technological redistribution) model of economic growth. In addition, increasing dependence on technology, imported materials and components in the most important sectors and areas of the economy (especially in the context of sanctions restrictions) in the context of technological backwardness generates risks of a "peripheral" model of socio-economic development amid the emergence of a limited group of leading countries that possess new production technologies and are oriented towards the use of renewable resources.

Conclusions or Discussion and Implication

In order to ensure a competitive development trajectory on the global stage and to face significant challenges, it is necessary to significantly increase spending on strengthening and building up the existing potential of the Russian scientific and technological complex. Otherwise, there are significant risks of encountering an unfavorable scenario in the R&D sector: a drop in the quality of education, an accelerating 'brain drain', an outflow of highly qualified specialists and talented scientists. This scenario is clearly not conducive to economic growth, let alone strengthening the economic potential of the country and its international competitiveness in a changing technological paradigm.

Acknowledgements

The work is performed according to the Kazan Federal University development program "Priority-2030".

References

Kondratiev N. D. Problems of Economic Dynamics. - Moscow: Ekonomika, 1989. - 536 p.
Schumpeter J. Theory of Economic Development. - Moscow: Progress, 1982. - 455 p.
The Innovation and Modernization Waves in Socio-economic Development: Technological Patterns, Macro-Economic Generation, a View to the Future. Book 1. Textile, Metallurgical, Oil Refining, Petrochemical Industry, Electric Power, Military Engineering. Yu.V.Matveeva, G.V.Semenova (Eds.). Samara, As Gard Publ., 2013.

Blockchain as a component of macro-generating cluster of the sixth technological mode / M.R. Safiullin, M.V. Savelichev, L.A. Elshin, V.O. Moiseev // Problems of Innovative Economy. - 2020. - V. 10. - № 3. - Pp. 1509-1522. – DOI 10.18334/vinec.10.3.110497.

Acemoglu D., Johnson S., Robinson J. Aghion P. and S.N. Durlauf (Eds.) Institutions as a fundamental cause of long-run growth [Digital source] // Elsa.berkeley.edu: Econometries Laboratory Software Archive. 1994-2003. URL: http://elsa.berkeley.edu/~chad/handbook9sj.pdf (access date: 01.09.2012)

C. Glazyev. Theory of Long-Term Techno-Economic Development. Moscow: Publishing House, 1993.

C. Glazyev. What kind of modernization does Russia need? // The Economist. 2010. № 8. P. 5-14.

Change in the content, material and material structure of the public (national) product in the process of innovation development / G.V. Semenov, U.V. Matveev, R.K. Khairullin, V.G. Ignatiev // Economic Sciences. - 2011. - № 83. - P. 44-52.

9. K.Y. Matveev. Innovation and Investment Resources and Models of New Quality of Economic Growth in Russia. Samara: Samara State University Press, 2008

10. Aghion P., Reenen J.V., Zingales L. Innovation and institutional ownership [Digital source] // Economics.harvard.edu: Harvard University Department of Economics. 2007. URL: 166 http://isites.harvard.edu/fs/docs/icb.topic256649.files/AghionEtAl_avrz.pdf (access date: 01.09.2012)

Lundvall, B.-A. National Systems of Innovation. – London Pinter. 1992

Aldaba, Rafaelita, et al. 2011. “Result of the 2009 Survey of Innovation Activities,” Discussion Paper 2011-15. Makati City: Philippine Institute of Development Studies

Bautista, Carlos. 2002. “Boom-bust cycles and crisis periods in the Philippines: a regime switching analysis,” The Philippine Review of Economics XXXIX (1): p. 20-37.

Hospers G.J., Benneworth P.S. (2012) Innovation in an old industrial region: the case of Twente. International journal of learning and intellectual capital, 2012, vol. 9 (1/2), 6-21.

Safiullin M. R., Elshin L. A., Abdukaeva A. A. Assessment of the relationship between cyclical fluctuations of the macro- and mesolevel economy: tools and its approbation / M. R. Safiullin, Elshin L. A., Abdukaeva A. A // Modern Science: Current Issues of Theory and Practice. Series: Economics and law. - 2019. - № 10. - P. 91-101. – EDN SNAHON.

M. R. Safiullin, Features of assessment of regional business cycles: Methodical approaches and paradigm of the research / M. R. Safiullin, A. A. Abdukaeva, L. A. Elshin // Journal of Environmental Treatment Techniques. – 2019. – Vol. 7. – No Special Issue. – P. 911-914.