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DISINCENTIVE FACTORS AND PRECONDITIONS FOR INNOVATION DEVELOPMENT OF NATIONAL ECONOMIES: INTERNATIONAL ASPECT

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Abstract: *The article deals with rather controversial influence of stimulating and disincentive factors on the innovation processes in national economies taking into account the achieved stages of innovation development, which are defined as innovation stagnation, activation of the innovation process and permanent innovation regime. The authors propose to separate approaches to understanding the essence of innovation development for developing economies and technologically developed countries, depending on what to consider the direction of action of innovation factors. While the countries belonging to the group of innovation leaders are undergoing a technological revolution, developing countries are solving the problems of forming national innovation system based on the mechanisms of interaction within the triple helix and ensuring the overcoming of innovation stagnation. The authors pay special attention to consideration of various innovation hindering factors, which are grouped into innovation challenges, threats and barriers, the effect being determined by the time horizon of action. This approach facilitates the search of effective measures of state regulation in the innovation sphere. Based on the results, the authors have proved the necessity of a closer international cooperation using various forms of networking interaction aimed at elimination of global technological inequality.*

Keywords*: innovations, factors, innovation development, national economy, infrastructure, networking cooperation.*

INTRODUCTION

Innovation processes are gradually involving the whole world economy into the sphere of their influence, but with varying degrees of intensity. Uneven economic growth as the global trend could not help but affect innovation activity of individual national economies. As a result, the technology leaders are adjacent to developing countries and technological outsiders and this situation has become persistent. This is evidenced by

international ratings, ranking the countries by the level of innovation development (The Global Innovation Index, 2019). In accordance with international trends, the development of an innovation model on a national level implies an expansion of innovative production presence in the technological structure of economy as a result of an increase in the number of innovation enterprises, volumes of innovative products and creation of qualitatively new markets. In accordance with the economic dynamics mechanisms, innovation processes are the result of sequential substitution of technologically connected productions (Glazyev, 1993).

The transition of the national economy to sustainable innovation growth requires maximum overcoming or elimination of the destructive factors influence. This requires their identification by the scale, strength, and duration of impact. At the same time, the intention to define universal factors without considering at least the stage of innovation development, which is occupied by the national economy, may lead to erroneous conclusions. The fact that one and the same factor may have both stimulating and disincentive influence should also be taken into consideration. An example is innovation infrastructure, created at the expense of budget funds in special economic zones, which in the case of lack of development of the national innovation system or lack of appropriate demand may be unclaimed. At the same time, in modern conditions the stimulating role of the state remains relevant regardless of the level of innovation development of the country.

World practice shows that at the initial stages of the innovation process formation state regulation plays a crucial role, and therefore, the necessity of systematization of innovation processes seems reasonable. The argumentative basis is the justification of their impact on maintaining a permanently low level of innovation development, identification of innovation challenges, threats and barriers depending on the time horizon of influence on innovation growth. Diversity and combinatoriality of innovation activity predetermine the possibility of regression and its overriding requires the implementation of effective organizational and managerial decisions aimed at coordinating the actions of all the participants of innovation process. This process creates conditions under which self-organization process, associated with positive evolutionary changes, can occur (Nikitskaya, 2018). Therefore, the research is aimed at comprehensive study of innovation factors with reference to fundamental scientific studies of Russian and foreign scientists on the problems of economic mechanism development.

MATERIALS AND METHODS

The purpose of this study is to summarize trends and identify patterns in mutual causation of destructive and positive factors influencing the development of innovation process on the macroeconomic level. The authors' concept is based on the stages of economic growth classic theory (Rostow, 1960), technological paradigm theory, Erich Yanch paradigmatic theory of global evolutionism (Huseykhanov, 2014). The authors focus on the complex structure of innovation activity taking into account its distinctive features compared with traditional production, using fact method - the study of facts recorded in modern scientific works, expert opinions and analytical studies. The results published in international innovation ratings The Global Innovation Index, Digital Economy and Society Index (DESI) (2020), statistical research of innovation activity indicators of Higher School of Economics (Gokhberg, Ditkovskiy, Kuznetsova, 2019), PricewaterhouseCoopers (PWC) survey (Creative Capital Index, n.d), international innovation networks The European Association of Development Agencies (EURADA)

(n.d.), World Alliance for Innovation (WAINOVA) (n.d.), Enterprise Europe Network (EEN) (n.d.) constitute the conclusive basis of the research.

The present research is based on combination of general scientific interdisciplinary and special economic methods, including analysis, synthesis, scientific comparison, inductive and deductive methods, structural analysis, which is the methodological type of system analysis, structural and logical modelling. To obtain and illustrate crucial results of innovation development in Russian economy the assessment of dynamics qualitative criteria of innovation activity of technological innovating organizations, as well as organizations operating in the sphere of telecommunication and information technologies. A lot of attention in the present research is paid to examination of economic categories peculiar to innovation-oriented economy. The conceptual structure defining the notions "innovation development", "innovation factors", "innovation process" etc. is specified, questions for discussions are additionally reasoned.

RESULTS

The expansion of innovation presence in the economy crucially depends on the ability of economy to make a progressive transformation, implemented in the world practice within the framework of national innovation system and provided that there are sufficient potential opportunities on national level. This predefines the emergence of factors that in one way or another affect innovation growth on the success achieved by the countries in innovation development. World technological trends, classified in the technological paradigm theory (Glazyev, 1993), precondition the breakdown of countries by level and scale of incorporation of scientific and technological achievements into economy. Consequently, at any time lapse on the level of national economies there are different variations of achieved level of innovation development – from primal economy of 1st and 2nd technological paradigms to innovation leadership in global economy.

The list of underdeveloped countries is the longest one, including many Asian countries and some countries of Africa with monocultural economy and very narrow specialization sphere (Underdeveloped countries of the world, n.d). Technologically developed and active in innovations countries, on the contrary, are relevantly few, their structure is stable and has not changed for many years. The level of innovation activity can be assessed by Global Innovation Index (GII), published since 2007 by Cornell University Consortium (USA), ISEAD Business School (France) and the World Intellectual Property Organization. GII-2019 rates the innovation activity of 129 countries by 80 indicators, including quantity of international applications for patents and trademarks registration, the volume of investments in R&D, the volume of hi tech production export etc (The Global Innovation Index, 2019). The first place in GII-2019 for the ninth year in a row is occupied by Switzerland, such countries as Sweden, USA, Netherlands, UK are in the top five. Russia occupied the 46th place in 2019. The main strengths of Russian economy are: the level of human capital and science development (23rd place in the subindex), the level of business development (35th place in the subindex), the level of technology and knowledge-based economy (47th place in the subindex).

Despite the "development" and "innovation development" economic categories widespread application, there is a necessity in clarifying their semantic meaning, due to the fact that the significance of concepts related to a certain cognitive approach changes in accordance with the chosen concept. The concept of "development" seems to be similar in meaning to the concepts of "economic growth" and "progress" – this often leads to their substitution in scientific works. Raymond Aron in his fundamental work "Theory of

development and modern ideologies" called growth the increase (gross or per capita) of the national product, identified development with the same growth when it is a product of change and progress – a development that meets the ultimate goals of the economy. Regarding the latter, Aron noted that "development consists not only in the production of goods in increase quantities, but, most importantly, of other goods and by other methods" (Aron, 2007, p. 665). Therefore, according to Aron, development, as an economic category, includes innovation basis.

And there the question arises: what then the essence of innovation development is. In response to this question, let us turn to the Walt Rostow paradigm of transition to modern society which defines five phases: traditional society, the creation of preconditions for the beginning of the recovery, beginning of the recovery, movement to maturity, mass consumption era (Rostow, 1961). Using the scientific analogy principle and taking into account the evolutionary nature of innovation process, we can distinguish four stages of the innovation process, implemented in accordance with the scheme: 1) innovation stagnation → 2) innovation 'acceleration'→ 3) innovative production expansion → 4) permanent innovation mode (Nikitskaya, 2018). In a more generalized version, it makes sense to combine the 2nd and 3rd stages into the "innovation process activation", thus shortlisting it to three stages. The characteristics of the innovation process stages in the context of government regulation are presented in Table 1.

At the initial stage innovation activity evolves to a large extent, while at the same time being exposed to uncertainty factors. The existence of the evolution of the environment and all it areas, including animate, inanimate nature and social society, is now a generally recognized observational and experimental scientific fact. A more accurate description of innovation development is provided by the theory of global evolutionism, which is inextricably linked with evolutionary theory. The difference between these theories is due to the fact that global evolutionism allows regression as a form of variability and transition to a non-equilibrium state. The fourth stage is the highest achievement of innovation development based on the self-organization of participants in the national innovation system. Technologically advanced countries have the following characteristics, which allows them to develop actively and sustainably (Huseykhanov, 2014). Based on the above, an expanded interpretation of the innovation development category is possible, which should be understood as the ability of the national economy to move to the next innovation stage, changing the quality characteristics of the innovation system to more progressive ones. At the same time, the increase in the scale of innovative production is only an external sign of the development, which allows us to refer this case to an extensive type of innovation growth.

Table 1. Main features of innovation growth process

STAGE	CONTROLLING/REGULATING ACTIONS AND/OR THEIR OUTCOMES
Innovation stagnation	• Choice of innovation development priorities, • Development of the legal framework for state regulation of innovation activities, • Overcoming innovation barriers, • Coalition of economic and political elites, • Formation of the national innovation system (NIS), • Formation of a system of incentives for innovators, etc.
Innovation process activation	• Strengthening the interaction of NIS participants, • Development of innovation infrastructure, • Creation of conditions for commercialization of technologies, • State support for innovation 'from below', • Attracting foreign investment, • Developing international cooperation, • Decentralization of the procedure for providing venture capital for new companies (startups), etc.
Permanent innovation regime	• Bringing the indicators of innovation development and technologies to the world level, • Implementation of all types of innovations, • Decentralization of innovation activities, • Mass participation of market participants in international innovation networks, • Development of a system of self-regulation in innovation processes, • Strengthening competitive positions in the technology sector at the international level, etc.

Source: drafted by authors.

The developing countries slow entry into permanent innovation mode is explained by the fact that innovative production is radically different from the traditional one, since unlike the production and commercial cycle, the innovation cycle is rather protracted, and its stages from basic research to commercial production should not be interrupted. Otherwise, the financial, tangible and human resources spent on an incomplete innovation cycle will not be translated into an innovative product. This is what determines the complex organizational and management structure of the innovation system, which involves a lot of participants who form at least a triple helix and implement a whole set of functions. At the stages of formation of an innovation economy, the problem of forming a national innovation system becomes unavoidable. This is hindered by numerous

macroeconomic factors, which are becoming difficult to overcome due to their systemic nature. However, the range of innovation inhibition factors can be significantly narrowed if we apply a casual approach (cause → mechanism → consequences) and distinguish three main types: *global innovation challenges, innovation threats, and innovation barriers* (Nikitskaya, 2013, pp. 75-76). The effect of these types of factors varies significantly. Their characteristics and some examples relevant to the Russian economy are presented in Table 2. Attribution of innovation factors to certain types is a debatable issue and it is difficult to avoid subjectivity in views and representations.

Table 2. Innovation development factors features

Factor type	Essence	Examples
Innovation challenges	Global socio-economic factors connected with the threat to national security	• Acceleration of technological development of world economy, • Possibilities of exhaustion of economic models oriented on export of raw materials, • Russia's technological lag during the period of market reforms in the 90s consolidation, • Emergence of New Russia's competitors in the field of innovation from developing countries, • Strengthening of global competition for highly qualified specialists.
Innovation threats	Destructive trend in economic and social spheres, connected with innovation sphere on macroeconomic level	• Maintaining of technological diversity of the economy, • Inefficient budget funding allocated for R&D, • Low level of research and innovation activity in the economy, • Insufficient level of corporate science development, • Insufficient training in innovation areas.
Innovation barriers	Pressing issues, currently creating real obstacles for full-sized launch of innovation mechanisms	• Lack of well-established national innovation system, • High risks in innovation entrepreneurship, • Lack or deficit of sources of venture capital, • Lack of qualified personnel, • Lack of experience in managing innovation projects, • The gap between resources and their effect, • Demand for innovations.

Source: Order of the Government of the Russian Federation No. 2227-r. (December 8, 2011).

In can be assumed that there is a similarity in the problems of innovation development in developing countries. Taking into account the Russian experience, we are going to determine the most general ones. Undoubtedly, the poor development of national innovation system is a higher priority, e.g. compared to the problem of shortage or absence of sources of innovation funding. The fragmented state of the national innovation system is extremely significant, because in this case, the funding of R&D, as well as the funding of innovation projects, is likely to be ineffective, since the economy is not sufficiently prepared for the transfer of technology to production.

As for other factors that hinder innovation growth, experts mainly identify those that relate to innovation threats and innovation barriers. This is the result of the group of scientists from the Higher School of Economics (Moscow), which carries out statistical studies of innovation indicators on a regular basis. The importance of factors that create obstacles to the introduction of innovations in economic processes in Russia is clearly shown in Fig.1 (Gokhberg, Ditkovskiy, Kuznetsova, 2019).

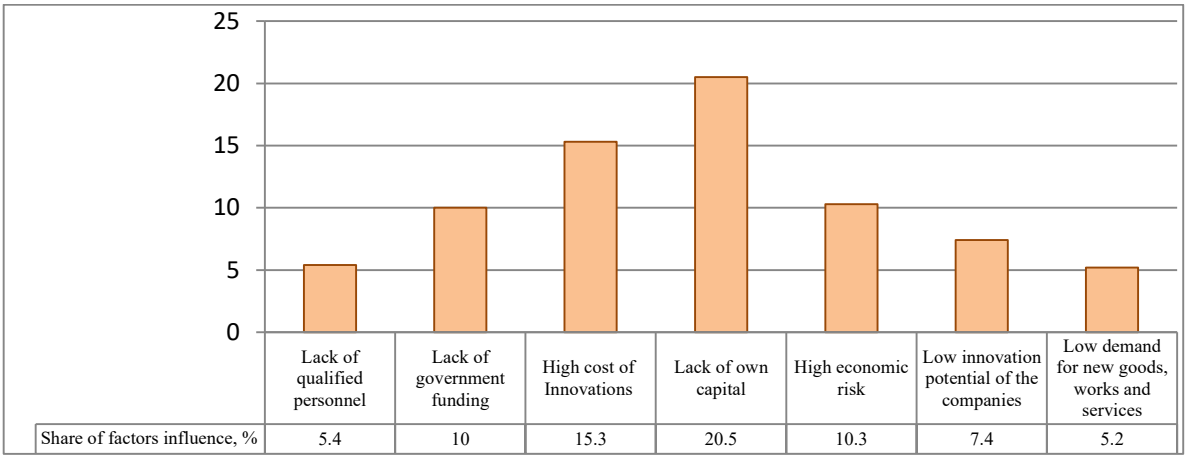


Figure 1. Main factors obstructing innovations (based on industrial companies' assessment), %.

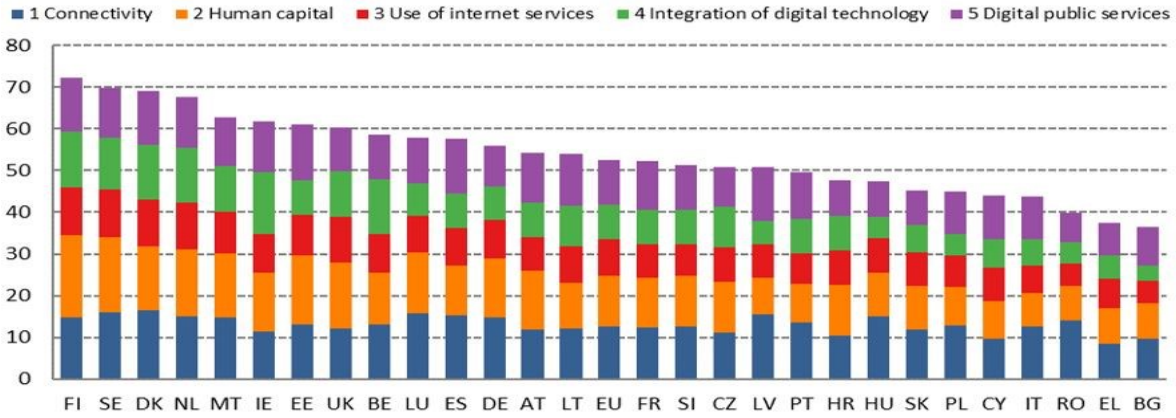
A completely different situation and different trends regarding innovation are taking place in developed countries. The following main area of factor influence should be considered: agglomeration effects, infrastructure factors, and the activities of international innovation networks. In Western Science the development of agglomeration is traditionally associated with the action of agglomeration effects through the prism of the process of agglomeration of production and population (Rusanovsky, Markov, Brovkova, 2018). Agglomeration territories are a concentration of high scientific and technological potential, and therefore create an additional effect due to the growth and spread of economic and innovation activity beyond their borders. The role of agglomerations in the world economy is growing due to the emergence of so-called techno- nationalism, the essence of which is the focus of all government decisions and strategies on the development of innovation exclusively at national level (Innovatsionnaya politika: globalnyi vzlyad, 2017).

The results of the territorial distribution of innovations study conducted by Crescenzi et al. (2007) revealed differences between the US and EU innovation systems. In the United States, the geography of innovative production is relatively more stable, due to the fact that the generation of knowledge and innovation flows usually occurs in certain locations, while in Europe, interregional interaction and, to a certain extent, balanced

distribution prevail. The rapid growth of China's innovation potential seems to be of interest. In China, more than 80% of all patent applications originated in densely populated provinces or municipalities – Guangdong, Beijing, Shanghai, Jiangsu, and Zhejiang. (Rodríguez-Pose, Wilkie, 2016). The research on innovation networks in Japan conducted by Y. Yokura et al. (2016) has found that scientific and technical projects are more often involved in long-distance cooperation, while low-tech production is carried out locally.

The assessment of the level of innovation development of the world's largest agglomerations is carried out by the international network of companies PricewaterhouseCoopers (PwC), which together with the British charity Calvert 22 Foundation has been publishing the Creative Capital Index since 2016. The PwC methodology provides an assessment of agglomerations based on the level of technology penetration, labor productivity, education level, and the level of development of the creative sector (Creative Capital Index, n.d). The index evaluates the creative capital indicators of 20 Russian cities (Moscow, Saint Petersburg, Voronezh, Veliky Novgorod, Vladivostok, Yekaterinburg, Kazan, Kaliningrad, Krasnodar, Krasnoyarsk, Nizhny Novgorod, Novosibirsk, Rostov-on-don, Samara, Omsk, Perm, Tyumen, Ulyanovsk, Ufa, Chelyabinsk), as well as 7 world capitals (Berlin, Hong Kong, new York, London, Seoul, Sydney, Helsinki). The initiative was driven by the increasing importance of the creative factor as a special resource for economic growth.

The process of organizing an innovation system is impossible without creation of a developed infrastructure. In general, economic infrastructure has an impact on economic growth in several ways: as one of the production factors, as an incentive for the development of production, as an incentive for demand for manufactured products, and as an instrument of state policy. There is not only a direct link between the level of infrastructure development and economic growth, but also the reverse one, i.e. the increase in aggregate demand for manufactured products requires the corresponding development of the infrastructure network (Khan et al., 2020; Pradhan, 2019). International research prove positive and statistically significant connection between IT infrastructure and innovation performance (Jabbouri et al. 2016), and innovation performance and information technology have become development factors for developing countries as well (David at al., 2016). Moreover, information technologies, the Internet and IT infrastructure have had a decisive impact on the formation and development of the digital economy. The European Digital Economy and Society Index (DESI) assesses the digital performance of Europe and monitors the evolution of the digital competitiveness of EU member states (Fig. 2). DESI is calculated as a composite index that summarizes various indicators of the development of digital Europe and has five main sub-indices: Connectivity, Human Capital, Use of Internet series, Integration of digital technology and Digital public services.



Source: Digital Economy and Society Index (DESI), 2020

Figure 2. Digital Economy and Society Index, 2020 (DESI-2020).

Speaking about Digital public services, according to DESI-2020 data, the top three countries are Sweden, Denmark and the Netherlands. Significant progress has been identified in Ireland, the Netherlands, Malta and Spain. In countries that over the past five years have demonstrated below the EU average level of digitalization, there have been no significant changes (Digital Economy and Society Index (DESI), 2020). Despite the obvious positive impact of IT infrastructure on innovation, general economic infrastructure components remain important, determined, for example, by indicators of road density, railway length, growth rates of capital and housing construction, wholesale and retail trade. This group of indicators is not directly related to innovative production, but as indicated by Wang J., Ren Y., and others. (Wang et al., 2020), defines the economic potential of infrastructure, is one of the most important components of the region's potential, which is a determining factor for the sustainable development of territories.

In the modern world, the dominant principle of organizing innovation processes is the construction of network models of development. Under certain conditions, open innovation systems may have self-organization processes associated with positive evolutionary changes. As O. Gafiatullina points out, open, nonlinear objects that maintain dynamic equilibrium by exchanging substance, energy, and information with the environment are key objects in the process of self-organization (Gafiatullina, 2015). This process has been reflected in the creation of international innovation networks and associations, which have developed along the path of stimulating transnational technology transfer and promoting innovative services.

In countries such as the United States, Australia, and the United Kingdom, innovation policies have shifted R&D funding and incentives toward promoting multi-industry innovation networks (Corley, Boardman, and Bozeman, 2006). Here are the examples of such networks: The European Association of Development Agencies (EURADA) (n.d.).; World Alliance for Innovation (WAINOVA) (n.d.); Enterprise Europe Network (EEN) (n.d.), etc. Nevertheless, the results of a study of the spatio-temporal impact of embedding in R&D networks on the production of regional knowledge in 229 European regions included in the Nomenclature of Territorial Units for Statistics (NUTS), conducted in 1998-2010, revealed positive effects resulting from network integration (Wanzenböck, Piribauer, 2016).

DISCUSSION

In the innovation process, we can talk about the opposing and simultaneous action of two groups of forces. One of them initiates the process of introducing advanced technologies into production, followed by the diffusion of innovations that "transcends" the borders of various industries and markets. The other group of forces hinders innovation development or creates a situation of innovation stagnation. The situation in which developed countries continue to develop along the path of evolutionary and revolutionary technological changes, and in developing countries the technological gap is growing, leads to a general innovation slowdown in the global space. A certain breakthrough in the uneven technological development is created by numerous international innovation networks. There is a certain drawback in the situation when informal links between participants in innovation networks based on declarations of cooperation, memoranda of understanding, etc. are unstable. However, the nomenclature of territorial units for statistics (NUTS) remains linked to the existing administrative divisions of EU countries, which prevents integration. In contrast to the current system, the World Alliance of International Financial Centers (WAIFC) promotes international cooperation, sustainable investment, and prevention of protectionism during global health and economic emergencies.

CONCLUSION

The present study separates approaches to understanding the essence of innovation development for developing economies and for technologically advanced countries. In the first case, innovation development should be manifested not only in expanding the scale of innovative production, but also in creating conditions for transition, or in the transition to a higher stage of innovation development itself, due to the improvement of the organizational and managerial environment and technological conditions. In the second case, we should focus on the priority of radical innovations associated with the technological revolution and the implementation of new forms of interaction between participants in the national innovation system, including the interstate level. As countries move to a higher level of innovation development, the role of the state is changing – self-organization is gradually replacing directive management and state regulation. At the same time, it is unacceptable to solve innovation tasks before the necessary socio-economic and technological conditions arise, since this can lead to useless expenditure of economic resources. Opportunities for evolutionary progress or regression in the field of innovation are related not only to the nature of public policy, but also to activities of international innovation networks focused on the development of mechanisms for financing and supporting innovation entrepreneurship within the framework of public-private partnership.

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