



Research Article

The Role of the Concepts of «Smart Specialization» and «Open Innovation» in Stimulating the Advanced Development of the Manufacturing Sector in the Russian Federation

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Abstract

The purpose of this article is to develop a model of innovation development, the "open innovator," with the definition of framework conditions, the role, and the place of the "open innovator" in this model, based on a combination of linear and nonlinear models of innovation development. The author's model of innovation development, the "open innovator," is based on the "triple helix" model with the addition of the "fifth helix." The formation of measures to implement mechanisms ensuring the advanced development of the scientific and technical potential of Russia's manufacturing industries, based on the principles of the concept of "smart specialization," is carried out within the "open innovator" model of innovation development. The methodological basis of the study is the "open innovator" model of innovation development, based on a combination of linear and non-linear models of innovation development, with the definition of framework conditions, the role, and the place of the "open innovator," and the concept of smart specialization. The methods used include analysis of scientific literature, the vector method for calculating the value and purposefulness of achieving management goals, and the systematization of activities based on the analysis of the national normative framework. Measures have been developed to implement mechanisms that ensure the accelerated development of the scientific and technical potential of Russia's manufacturing industries, both from the perspective of the industrial system and from the perspective of the innovator, within the framework of the "open innovator" model of innovation-driven development.

Keywords

Innovation Development Model, Innovation Model, Model of Innovation Development, Open Innovator, Manufacturing Industries, Manufacturing

1. Introduction

The study of the role of innovation as a factor of economic growth, the development of new models, and the evolution of

existing models of innovative development are currently relevant topics of research in the scientific community. The development of innovation models in a historical perspective is

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in the process of formation of the "open innovator" model, the essence of which lies in defining the individual and framework conditions of the innovator's activity. Creating an integrated national innovation model (from idea to market) and defining the role of the innovator in it will ensure a high level of innovation activity [13]. The structure of the innovation system should include innovation actors, infrastructure, and the legal and regulatory framework of innovation processes; at the same time, it depends significantly on the innovation strategy in a particular time period [19]. Innovation is characterized by the uncertainty and unpredictability of the innovation process, which poses the challenge of creating management systems in models of innovative development (national innovation systems – hereinafter referred to as NIS) [21].

Industrial enterprises and organizations are also an integral part of the NIS, and their innovative development is essential to improving how the NIS functions. Practice shows, however, that developing the scientific and technical potential (hereinafter referred to as STP) of Russia's manufacturing industries through capital investment alone is insufficient; other mechanisms are required [15].

Recently, the concept of "smart specialization" has become widespread [14]. It defines the strategic priorities of innovation policy and seeks to create mechanisms for managing and applying "smart policy" so as to maximize the realization and development of the available STP.

In this regard, the implementation of "smart specialization" in industry [4] – aimed at introducing innovations and strengthening the STP of the industrial complex [23] – is reasonable to consider as a mechanism for ensuring the advanced development of Russia's manufacturing industries and of the national economy as a whole, with a view to smart economic growth.

The concept of "smart specialization" is a driving force of structural change. It makes it possible to build models of innovation development and, as a sectoral policy that promotes bottom-up entrepreneurial initiative, occupies a special place within the NIS [8].

The purpose of the article is to propose and justify the use of the principles of the concept of "smart specialization" as a specific management mechanism in the author's model of innovation development "open innovator", and to form measures for the implementation of mechanisms to ensure the advanced development of STP of manufacturing industries in Russia both from the perspective of the industrial system and from the perspective of the innovator in the model of innovation development "open innovator".

2. Materials and Methods

Well-organized NIS are powerful engines of economic growth, while poorly organized NIS can inhibit innovation [5]. Innovation provides the formation of patterns of innovation development and acts as a basis for scientific and technological development [20]. "Open innovation mainly takes place in

industry" [25], utilizing open platforms to create and sustain innovations that can be promoted through governance mechanisms within the NIS. Russia's NIS is based on the "triple helix" model, which has the following features: an extensive network of organizations performing R&D; the leading role of the business sector as the main consumer of R&D results in the structure of funding sources; an institutional system of support for innovation activities; a diverse set of measures aimed at stimulating and supporting organizations that perform R&D for a long period of time; a counterflow of demand for innovation in industry [12]. One of the examples of successful implementation of the "triple helix" model in Russia is the cooperation of Tomsk State University of Radioelectronics and Control Systems with industrial enterprises that are part of the educational, research and innovation complex, which results in the development of their own technologies, the development of STP of industrial enterprises and the output of 80% of all knowledge-intensive products of the Tomsk region [16]. At the present stage, the models of innovation development also distinguish "four-link" and "five-link" innovation spirals. Based on the trends in the formation of innovation development models, it is advisable to build an integral NIS of Russia on the basis of the modern model of innovation development "open innovator".

2.1. The Innovation Development Model «Open Innovator»

The model of innovation development, proposed by the author, is based on the Triple Helix [6] and Quintuple Helix [2] models. The author's hypothesis regarding the innovation development model (Figure 1) defines the framework conditions and the role and place of the «open innovator» [11]:

1. The innovation development model proposed by the author is based on the Triple Helix [6] and Quintuple Helix [2] models. The author's hypothesis regarding the innovation development model (Figure 1) defines the framework conditions and the role and place of the "open innovator" [11]:

$$N_m \in GVP \setminus RVI \setminus EV \dots m \setminus In \quad (1)$$

where N_m – innovator(s);

G, P, R, I, E – institutional systems, spaces;

In – innovations.

$$N_m \Rightarrow In \text{ or } In \Leftarrow N_m \quad (2)$$

2. The framework conditions and the role and place of the "open innovator" are defined by the following conditions in the innovation creation phase:

$$N_m \in In \quad (3)$$

$$(D_m \Leftrightarrow S_m) \in T_m \quad (4)$$

where D_m – demand of the results of innovation;

S_m – suggestion of the results of innovation

T_m – time.

3. During the mastering phase of the innovation, the individual's conditions, role, and place as an "open innovator" are determined by the following factors:

$$In \Rightarrow GVPVRVIVEV...m \quad (5),$$

further along the cycle (item 1).

4. Conditions (2), (3), (4), and (5) are implemented through management mechanisms.

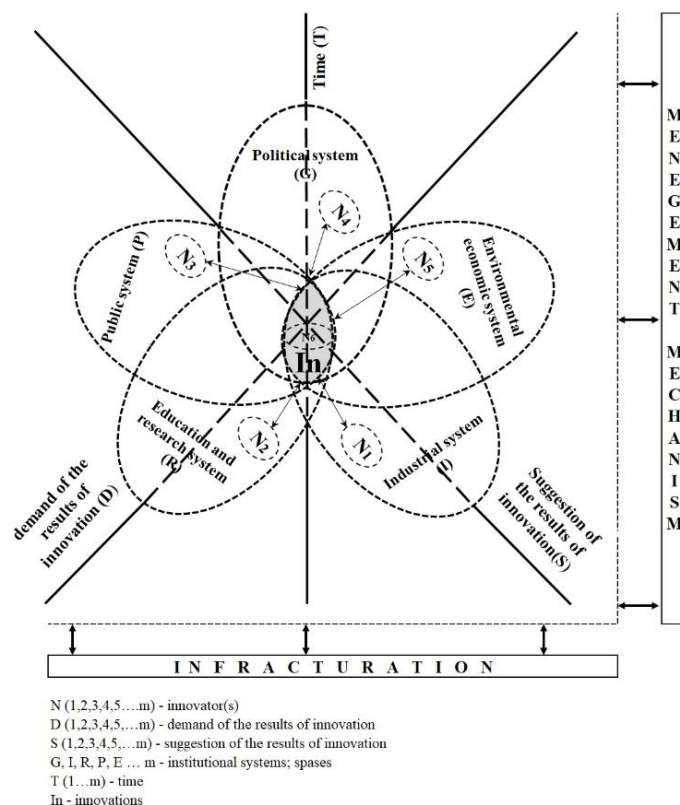


Figure 1. The innovation development model «open innovator».

Findings and expected outcomes: The framework conditions, role, and place of the «open innovator» in the innovation creation phase have the following characteristics:

a) From an institutional point of view, the role of the innovator can be performed by individual researchers as well as research teams, organisations, institutions, compounds, and associations; from a spatial point of view, it involves knowledge, insights, ideas, hypotheses, know-how, etc.

b) The suggestion of the result of innovation (S) and endogenous factors will contribute to the drive of N_m into the In zone, while the reverse process – the pull of N_m into the In zone – will be influenced by the demand for the result of innovation (D) and exogenous factors.

In the spreading phase of innovations, when N_m is in the In zone, individual «open innovator» conditions come into play, characterised by the fact that reaching the equilibrium

value of the innovation results ($D_m \Leftrightarrow S_m$) – the actual start of the diffusion of innovations – for each innovator occurs at a specific time (T). Over time, the disseminated In will develop and transform into $GVPVRVIVEV...m$. Institutionally, this may be characterised by the formation of new companies, organisations, and alliances, and spatially by the introduction and dissemination of new knowledge.

2.2. Management mechanisms in the "open innovator" innovation development model

The management mechanisms designed to ensure the advanced development of Russia's manufacturing sector, based on the principles of the "smart specialization" concept [7, 17], are presented in Table 1.

Table 1. Mechanisms for Ensuring the Leading-Edge Development of the "Open Innovator" in Line with the "Smart Specialization" Concept within the Author's Innovation Model

Mechanisms for ensuring the leading-edge development of an "open innovator" in accordance with the provisions of the "smart specialization" concept	Which conditions of the «open innovator» model of innovation are implemented by the mechanisms listed in column 1
Mechanisms of government support for fostering collaboration among the public, industrial, scientific, civil society, environmental, and other sectors	$N_m \in GVPVRVIVEV...mVIn$
Mechanisms for developing and managing competitive advantages to identify a unique specialization and a competitive form of economic activity	$In \Leftarrow N_m$
Economic mechanisms to support entrepreneurial innovation and help businesses identify new opportunities	$N_m \Rightarrow In$
Mechanisms for interregional cooperation	$N_m \in In$
Organizational and economic mechanisms for stakeholder collaboration	$(D_m \Leftrightarrow S_m) \in T_m$
Legal and economic mechanisms for the development of new types of economic activities	$In \Rightarrow GVPVRVIVEV...m$

*Compiled by the author.

The implementation of the "smart specialization" strategy can be based on strong knowledge-intensive clusters. Their formation relies on the triple helix concept – the interaction of universities, business, and government [3] – which to some extent forms the innovation zone within the "open innovation" model of innovation development.

3. Results

The strategy of advanced development of the national economy should include accelerated growth of industries [9], stimulation of the existing STPt, and full disclosure of STPt. One of the possible solutions may be the stimulation of scientific and technological development of industry [24]. It is the advanced development of STPt of manufacturing industries in Russia that will make it possible to solve the most important socio-economic tasks [22] and ensure significant growth of the national economy. The formation of measures for the implementation of mechanisms to ensure the advanced development of STPt of manufacturing industries in Russia in the

model of innovation development "open innovator" based on the principles of "smart specialization" should be based on "purposeful activity to acquire a high-quality state, to ensure progressive and sustainable development based on various factors that allow the efficient use of resources" [1], which will solve the challenges of the current decade for the national economy: to eliminate the shortcomings of the national economy and to ensure the sustainable development of the national economy.

In order to formulate measures for advanced development, it is necessary to identify specific components of the scientific and technical potential (STPt) of Russian manufacturing industries, the effective use of which will ensure the advanced development of this potential. In accordance with the 5th level (forecasting of STPt development) at the 8th stage of the author's forecast-management model for assessing scientific and technical potential [10], the development of the STPt index I_{STPt} is forecasted using MS Excel based on statistical data from Russian manufacturing industries for 2015–2023. This forecast serves as the goal of STPt management for Russian manufacturing industries (Table 2).

Table 2. Goal I_{STPt} of the Russian manufacturing industries management.

Forecast years	Forecast values of the STPt index
2024*	1,50
2025	1,49
2026	1,47
2027	1,45
2028	1,44
2029	1,42
2030	1,40

Forecast years	Forecast values of the STPt index
2031	1,38
2032	1,37

*Compiled by the author.

To achieve the set management goals – the forecast values of the STPt index for Russian manufacturing industries at the 6th stage – the value of management goal achievement σ at the 9th stage of the author's forecast-management model for assessing scientific and technical potential is presented in Table 2 and calculated according to the formula:

$$\sigma = \frac{(B,A)}{|A|^2} 100\% = \frac{\sum_{i=1}^n b_i a_i}{\sum_{i=1}^n a_i^2} 100\% \quad (6)$$

and purposefulness of achieving the management goal α according to the formula:

$$\alpha = \cos \beta = \frac{(B,A)}{|B||A|} = \frac{\sum_{i=1}^n b_i a_i}{\sqrt{\sum_{i=1}^n b_i^2} \sqrt{\sum_{i=1}^n a_i^2}} \quad (7)$$

groups, blocks, and sub-blocks of components of the STPt in Russia's manufacturing industries [18].

Table 3. Value of management goal achievement and purposefulness of achieving the management goal of STPt of manufacturing industries in Russia

Components	Value of management goal achievement σ	Purposefulness of achieving management goal α
Group of internal components	291,794	0,998
Block of personnel (labor) potential	94,046	0,992
Share of the number of employed persons by level of education and qualification	91,894	0,992
Share of personnel engaged in research and development	2,152	0,991
Block of material and technical potential	6,075	0,994
Material potential	1,649	0,995
Technical potential	4,426	0,991
Information capacity block	2,443	0,988
Block of innovation potential	15,350	0,979
Share of innovative goods, works, services	12,434	0,970
Block of technological potential	39,553	0,975
Intangible capacity block	0,054	0,870
Organizational capacity block	67,641	0,997
Legal capacity block	1,682	0,991
Financial capacity block	2,030	0,995
Investment potential block	1,538	0,987
Tax potential block	52,739	0,970
Fiscal capacity block	0,443	0,945
Share of expenditures on technological innovations by sources of budget financing	0,443	0,945
Block of entrepreneurial potential	8,202	0,871
Group of input components	0,537	0,983

Components	Value of management goal achievement σ	Purposefulness of achieving management goal α
Group of output components	0,057	0,859

*Compiled by the author.

The calculations of the value σ and purposefulness α of achieving the management goal indicate that the development of internal components, primarily organizational potential, is the most effective way for the advanced development of the STP of manufacturing industries in Russia.

To accelerate progress toward the future (projected) state of

the scientific and technical potential (STP) of Russia's manufacturing sectors (Table 2), measures must be taken to implement mechanisms ensuring the accelerated development of STP in Russia's manufacturing sectors with regard to the organizational capacity component (Table 4).

Table 4. Measures to implement mechanisms ensuring the advanced development of STPt in Russia's manufacturing industries within the "open innovator" innovation model, based on the principles of the "smart specialization" concept.

Mechanisms for ensuring the leading-edge development of an "open innovator" in accordance with the provisions of the "smart specialization" concept ¹	Measures ²	
	STPt of Russian manufacturing industries in the «open innovator» model of innovation development as an industrial system (I)	STPt of Russian manufacturing industries in the «open innovator» model of innovation development as innovator(s) (N)
Mechanisms of government support for fostering collaboration among the public, industrial, scientific, civil society, environmental, and other sectors	Establishing the legal framework for a new organizational and legal structure: a research consortium	Providing legal protection for the integration of innovative R&D projects into existing production at newly established demonstration zones for R&D implementation
Mechanisms for developing and managing competitive advantages to identify a unique specialization and a competitive form of economic activity	Establishing a legal framework for preferential innovative scientific and technical centers in specific territories and areas	Allowing innovators, startups, and fast-growing technology companies to apply experimental legal frameworks in specific sectors
Economic mechanisms to support entrepreneurial innovation and help businesses identify new opportunities	Regulatory framework for supporting innovative projects involving high-risk investments in technology companies	Providing legal protection and removing regulatory barriers to innovation and the intellectual property market in the interests of developers, entrepreneurs, and investors
Mechanisms for interregional cooperation	Testing new organizational and legal structures in pilot areas established for the implementation of innovations and fundamentally new technologies	Development of uniform standards and guidelines for the operation of an interregional network of innovation and technology transfer centers
Organizational and economic mechanisms for stakeholder collaboration	Establishing and implementing-preferably at the national level-transparent and stable regulatory standards governing the conduct and interaction of actors in innovation and technological development	Regulation of the legal relationship between an innovator (rights holder) and the state regarding R&D projects initiated by innovators and funded with their own resources, which are necessary for state needs
Legal and economic mechanisms for the development of new types of economic activities	Providing legal protection for regarding R&D projects that are being transformed into operational production facilities based on demonstra-	Providing legal protection for intellectual property rights of innovators, startups, and fast-growing technology companies

¹ According to Table 1 in the paper

² Based on the Decree of the President of the Russian Federation dated December 1, 2016. N 642 «On the Strategy of Scientific and Technological Development of the Russian Federation» // Garant [Electronic resource]. URL: <https://base.garant.ru/71551998>; Order of the Government of the Russian Federation from 06.06.2020 № 1512-r «On approval of the Consolidated Strategy for the development of the manufacturing industry of the Russian Federation until 2024 and for the period until 2035» // Garant Garant [Electronic resource]. URL: <https://www.garant.ru/products/ipo/prime/doc/74142592>; Order of the Government of the Russian Federation from 20.05.2023 N 1315-r «On approval of the Concept of technological development for the period up to 2030» (together with the «Concept of technological development for the period up to 2030») // ConsultantPlus [Electronic resource]. URL: https://www.consultant.ru/document/cons_doc_LAW_447895

Mechanisms for ensuring the leading-edge development of an "open innovator" in accordance with the provisions of the "smart specialization" concept ¹	Measures ²	
	STPt of Russian manufacturing industries in the «open innovator» model of innovation development as an industrial system (I)	STPt of Russian manufacturing industries in the «open innovator» model of innovation development as innovator(s) (N)
	tion zones for the industrial development of regarding R&D	

*Compiled by the author.

4. Conclusions

The author formulates measures to implement mechanisms ensuring the advanced development of the scientific and technological potential (STP) of Russian manufacturing industries, from the standpoint of applying this potential within the "open innovator" model of innovation development. This model is presented as a single platform for the formation of the national innovation system (NIS), the regional innovation system, and the sectoral innovation system, as an industrial system (I) and innovator(s) (N). The originality and value of the presented "open innovator" model of innovation development are as follows:

1. The framework conditions and the role and place of the "open innovator" in the model of innovation development are defined.

2. The management mechanisms in the refined "open innovator" model of innovation development are based on the provisions of the principles of the "smart specialization" concept.

Applying the provisions of the principles of "smart specialization" as a management mechanism within the "open innovator" model of innovative development to ensure the leading-edge development of the manufacturing sector will make it possible to create and develop networks of "innovators" to implement transformative measures and structural changes within the national (regional) economy.

The measures themselves correspond to the provisions of normative legal acts adopted within the framework of the scientific and technological development of the Russian Federation and the development of the manufacturing industry of the Russian Federation. The work systematizes the measures of normative legal acts for STP, the effective use of which, according to the results of calculations of the purposefulness of achieving the management goal, will ensure the advanced development of STP in the manufacturing industries of Russia within the innovation development model of the "open innovator." It is the implementation of these measures, as it seems, that will allow, according to the normative legal acts considered in the study, achieving national development goals by 2030–2035: the transition to innovation-oriented economic growth, maintaining annual growth rates of the manufacturing industries of Russia at a level of at least 104.5% in 2023–2025 and at least 103% in 2031–2035, and increasing the share of

manufacturing industry organizations engaged in technological innovation by 1.6 times by 2030.

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The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

The author declare no conflicts of interest.

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