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## **IMITATIONAL MODELS OF THE INNOVATION DEVELOPMENT OF A COUNTRY IN CONDITIONS OF INTERNATIONALIZATION OF THE ECONOMY**

*The article reveals the characteristics and differences of the innovation process in the countries-leaders and countries-outsiders in innovations. Also the contents of the innovation process of the leaders in innovations are displayed here. In the end there are proposals for using the most perspective models of the innovation development for the Republic of Moldova.*

*Imitational modeling* allows the forming of a conditional model of the innovation process in countries – leaders in innovations, which can be then used for the countries – innovation outsiders, including the Republic of Moldova.

The basis of the imitational modeling is the creation of the effective system for monitoring the global transformations of the World Economy, national Research and Development (R&D) progress and changes in the global innovation sphere.

Nowadays the imitation of the innovation process should be primarily based upon the qualitative estimation due to high variety of countries and conditional character of the comparison of quantitative parameters.

**Goals** of the imitational modeling of the innovation process are the following:

1. Definition of attributes and features of the innovation process of countries – innovation leaders with the highest reliability;
2. Selection of universal and characteristic trends of the innovation process of countries – leaders in innovations;
3. Development of the algorithm of using the macro indicators in the imitational model;
4. Definition of the input and output parameters of the innovation process and its imitation;
5. Creation of the set of parameters for estimation of attributes, features, etc.

The imitational model should **reflect the quantitative and qualitative sides of the national innovation process; include the mechanism of adapting to certain socio-economic conditions of a country – innovation outsider.**

1. Thus the following **stages of the imitational modeling** can be displayed:
2. Structural analysis of the process and estimation of the roles of its elements;
3. Collection of information and definition of the basis and moment of modeling;
4. Classification and systematization of the modeling factors and conditions;
5. Selection of criteria and indicators and forming their interrelations;
6. Comparison of the trends in changing of the indicators on the global scale, in countries – leaders and outsiders in innovation;
7. Definition of the common and different trends, attributes and characteristics of the innovation process;
8. Description and creation of the model;
9. Interpretation of the model;
10. Modification of the model, prediction of changes and elaboration of methods of realization of the imitational model.

The imitational modeling can be represented in the following consecutive circuit:

1. Setting goals and objectives of the imitational modeling;
2. Collection of information;
3. Definition of factors, conditions and attributes of the innovation process in the countries – leaders;
4. Organization and classification of factors and conditions;
5. Characteristic of the interrelations of factors and conditions as a single item;
6. Selection of criteria and indicators that characterize the innovation process in countries – leaders;
7. Creation of the quantitative and qualitative components of the imitational model and its modification according to the conditions in the country.

Imitational modeling of the national innovation process is related to modeling of complex systems consisting of a great number of interconnected elements. The condition of optimization – the effective functioning of the innovation sphere and the development of the innovation process – is introduced in this case. The presence of the management of the innovation process, its structure and hierarchy create the possibility of its imitation. Multiple possible conditions and characteristics of the studied phenomenon are investigated and modeled according to the scope of functioning – intensification of the innovation development of a country. [3, p. 230]

The imitational model being created should be included in the analytical kind of models. In other words, it is a set of functional parities and logic conditions describing links between the elements and functioning of the process.

The **criteria of the imitational modeling** are the following:

1) **Economic criterion** – It estimates the functioning of the innovation process as an economic system, economic results of the innovation process and includes the economic indicators and parameters (volume of manufacture and export in R&D products, R&D expenses, investment efficiency, share in the global volume of innovations, etc.);

2) **Socio-economic criterion** – It considers the socio-economic aspects of the innovation process; may include the ecological and cultural elements; is represented by the indicators characterizing the social sphere of R&D (number of researchers, the share of researchers engaged in the national innovation process in their total number, etc.);

3) **Criterion of stability and balance of development** – It estimates qualitative elements (indicators) of the socio-economic development on the basis of intensification of the innovation process (economic system, culture, education, public health services, ecology) with concentrating on the social parameters of development;

4) **Institutional criterion** – It works with the indicators of the institutional maintenance of the innovation process (intellectual property protection, effectiveness of legislation, presence of institutions of the innovation infrastructure, etc.);

5) **Functional criterion** – It estimates the indicators and attributes of realization of the innovation process and interrelations among its elements, and also interaction of the state and the private sector; includes

various indicators reflecting the qualitative side of the innovation process (partnership between the state and corporate structures, aspects of organization and management, development of the innovation market, motivation and adaptation of the economy to innovations, etc.).

The characteristic features and differences of the innovation process in countries – leaders and outsiders in innovations are represented in the Table 1 below.

**Table 1 – The characteristic features and differences of the innovation process in countries – leaders and outsiders in innovations.**

<b>Main Attributes</b>	<b>Countries – leaders</b>	<b>Countries – outsiders</b>
<b>Management of scientific and technological development.</b>	Realization of the systematic policy on science and technology on the basis of the strategy of scientific, technological and innovation development.	The policy on science and technology is not realized in the systematic manner. The strategy of the innovation development is implemented relatively weak.
<b>Economic characteristics of the innovation process.</b>	Innovation process has high profitability and socio-economic effectiveness, along with the growth in resource expenditures.	Innovation process has high profitability, but the socio-economic effectiveness is not so significant.
<b>Social aspect of the innovation process.</b>	The intellectualization of the population, preparation and mobilization of high quality stuff are stressed here. The immigration is stimulated.	Level of the population's intellectualization is falling. Preparation of high quality stuff is not progressing. Labour force mobilization is low. There is an outflow of the labour force.
<b>Main sources of innovations.</b>	They are the states and large corporations, all elements of the scientific innovation system, and the high-tech complex.	The state sector and large corporate entities are characterized by low innovation activity. The R&D elements are weakly integrated and function mostly apart from each other.

<p><b>Financing of the innovation process.</b></p>	<p>The sources are diversified, but the dominating one is the private financing. State financing is realized both in direct and indirect forms. Amount of financing from the major sources is quite large.</p>	<p>The diversification of the sources is not significant. The main sources are the states and large corporate entities from the traditional branches. The amount of their financing is relatively small.</p>
<p><b>Development of the innovation structure and mechanisms of R&amp;D integration.</b></p>	<p>Institutions of the innovation infrastructure are characterized by the high level of functional effectiveness. Various mechanisms of integration of the R&amp;D elements are realized (administrative, market, etc.).</p>	<p>The number of institutions of the innovation infrastructure is small, and they are characterized by low level of functional effectiveness. Mostly the administrative mechanisms of the R&amp;D integration are realized, which do not provide close interrelations between the elements.</p>
<p><b>Distribution and implementation of innovations.</b></p>	<p>Distribution of innovations takes place through the innovation market and by the channels of large corporations and clusters with the state's participation. Implementation of innovations is intensified and has a systematic character.</p>	<p>Distribution of innovations is done by the channels of the state sector and large corporate structures with the state's participation. Implementation of innovations is not systematic.</p>
<p><b>Role of the state in the innovation process.</b></p>	<p>Active creation of various conditions for supporting the innovation process. Regulating on the basis of a large number of instruments and mechanisms.</p>	<p>Active creation of conditions is limited. Regulating and supporting the innovation process is not very efficient. The number of mechanisms is limited.</p>
<p><b>Functioning of the state sector.</b></p>	<p>Developed scientific and innovation spheres are actively engaged in the innovation process in various forms (as the source of innovations, participant of cooperation, resource basis). The education system is paid a lot of attention and is used as the instrument of the state control.</p>	<p>Development of the state sector is limited. The present institutes are not actively involved in the innovation process. The education system is developed slowly and weakly engaged in the state control.</p>

<b>Interrelations between the state and the private sector.</b>	Close partnership in all spheres and on different levels is realized. The volumes are expedient in certain moments. The market mechanisms are dominating.	Is characterized by speculative aspects. Is registered on certain stages. Can be realized in contradiction to the market mechanisms.
<b>Economic activity of the state in the innovation sphere.</b>	Has a complex, effective and systematic character. The state mechanisms are effective and are realized in different forms (state order, technology transfer, partial participation).	Do not have a complex and systematic character. The effectiveness of the mechanisms is limited. Small number of reforms is implemented.
<b>Regional policy on the micro and macro levels.</b>	The innovation orientation is focused both on the micro and meso levels. Economic development and competitiveness are determined by the innovation activity.	The innovation orientation is the main one neither on the micro nor on the meso levels. Economic development and competitiveness are determined by the resource and labour force capacity.
<b>Character of interrelations between R&amp;D and the global innovation and economic environment.</b>	Active participation in the global competitive environment, international programs of scientific and technological development, and international cooperation.	Weak participation in the global competitive environment, as well as the involvement in the international programs and the cooperation system in the innovation sphere.
<b>Impact of innovations on economic development.</b>	The expenditures and effects from innovations are in constant growth. The innovations of economic growth are dominating. High correlation dependence among the indicators of innovation and economic development is realized.	The innovations of redistribution are dominating, which leads to economic decline. The correlation dependence among the indicators of innovation and economic development is very vague.

The macro indicators used in the imitation of implementation and distribution in the innovation modeling can be conditionally divided on several groups: *socio-economic, financial and economic, and situational and economic indicators*. They comprise numerical characteristics of the major attributes of the countries – leaders in innovations.

### 1) **Socio-economic indicators:**

- ☒ Specific weight of the number of researchers in the world indicator;
- ☒ Grade of involvement of high quality stuff into the innovation process;
- ☒ Quantity and rate of changing of personnel involved in the scientific, innovation and manufacturing domains;
- ☒ Volume and quality of the intellectual resources of activity.

### 2) **Financial and economic indicators:**

- ☒ Share of the R&D expenditures in the GDP in the absolute amount (capacity of science in the economy) and in calculation per capita of the population;
- ☒ Share of the national R&D expenditures in the national amount of financing the innovation progress;
- ☒ Effectiveness of investments in R&D.

### 3) **Situational and economic indicators** (structural, conjectural):

- ☒ Number of the registered patents in general, abroad, state, and cooperative ones;
- ☒ Share of innovations and high-tech products on the global market;
- ☒ Quantity of the manufactured and realized innovations and high-tech products;
- ☒ Volume of export of innovations and high-tech products;
- ☒ Number of companies and enterprises active in innovations;
- ☒ Quantity and effectiveness of institutes of the innovation infrastructure;
- ☒ Self-provision with innovations;
- ☒ Number of publications per 1 million of the country's population;
- ☒ Development of small and medium business (quantity, division by types);
- ☒ Number of the realized state programs.

While creating the imitational model of the innovation process, the most important thing that should be considered is the evaluation of the situation and trends of the socio-economic development of the country – leader in innovations and of the country, which the model is used for.

Current conditions require that the imitation of the innovation process must be primarily based on the qualitative criteria evaluation, which is conditioned by significant differences of the states, difficulty of the analyzed phenomenon and conditional character of comparing the quantitative parameters.

Nowadays in Economics three main types of models of the innovation development of the industrially developed countries are defined:

1) *Orientation on the reserves in science* and realization of large-scale projects comprising all stages of the scientific and manufacturing cycle (France, the United Kingdom, the USA);

2) *Orientation on the spreading of innovations*, creation of the favourable innovation sphere and rationalization of the economic structure (Germany, Sweden, Switzerland);

3) *Orientation by the development of the innovation infrastructure*, ensuring of the receptivity of the R&D achievements and coordination of different sectors in the sphere of science and technology (Japan, South Korea).

### **Conclusions and proposals:**

In conclusion, we consider the most perspective models of the innovation development for the Republic of Moldova are the following:

1) **Model of the centralized management of the investment activity in the innovation sphere.** The model is aimed on the usage of the best technologies for manufacturing cheaper and in the same time more qualitative products. The main responsibility of the local authorities in the development of this model will be the contribution to increasing the scientific and technical potential of the country and its adapting to the amount that can be compared to the developed countries.

2) **Model of the regional priorities of the innovation development.** Before the development of the regional innovation programs there should be the definition of the regional innovation priorities that would not contradict the state ones and consider the regional peculiarities of the industrial, resourceful and scientific potential. Thus the concretization of the structure and expected results of the implemented programs should be done by including in the programs the projects with concrete executors on the competitive basis.



3) **Model of the effective usage of concentration of the innovation development.** The model considers that the innovation development in the Republic of Moldova begins not from the zero level. Certain industries are characterized by significant concentration of the scientific, manufacturing, financial potential.

4) **Model of the international cooperation in the innovation sphere.** The concept of the model is its orientation on the Moldova's active participation in the international scientific and technical cooperation and wide exchange of scientific results and modern technologies.

5) **Model of the single innovation space of the CSI.** It is based on the scientific and technical cooperation among the states, manufacturers and organizations within the CSI on common programs and orders.

However, considering the specific situation and development trends of the innovation potential of Moldova nowadays it is advisable to implement the **Model of the international cooperation in the innovation sphere together with the Model of the single innovation space of the CSI.**

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