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DEVELOPING THE CONCEPTS  
OF PRODUCTION FACTORS  
IN INNOVATIVE ECONOMY

Hannover 2014

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Developing the concepts of production factors in innovative economy

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# **Developing the concepts of production factors in innovative economy**

## **Basics of the work**

**Timeliness of the research topic.** In the early XXI century on the stage of globalization and generation of the knowledge-based economy the choice of theoretical models fitting the present-day micro- and macroeconomic environment is of particular applicability. The necessity to ensure priority of high technologies is obvious, and this calls for creation a methodological procedure for the innovative development policy. Timeliness of the selected topic is that environment for innovative development are necessitating not only looking for any new combinations of customary factors of production, but for creation a new one, however, in the current economic doctrines the problems of taxonomy of factors of production participating in innovative interactions are not considering as a single set.

Not only in textbooks but in governmental, analytical documents any predictions and conclusions for the most part are basing on traditional classification of factors of production and, consequently, the old treatment of such expressions as income, profit, rent income, fundamentals of economic relations which are typical for industrial economy is applicable.

The essential feature of this problem is in impossibility by means of traditional approaches and methods of analysis to understand and explain in theory a large number of conflicting occurrences, new facts showing themselves in all spheres of economy and society. In our opinion, the remarkable trend here is a change in the meaning content of factors of production in the modern economics (in particular related to substitution of material components of finished products by intellectual components), i.e. economic value of such factors as natural raw materials and manual work as the basic one is decreasing while explicit and implicit knowledge are turning in the primary production resource.

It is evident that options for settlement of problems relating to

theoretical understanding of current transformation of scientific categories should be taken into consideration in the course of efficiency calculation, making political and economic decisions. Among other things these questions should be settled on the grounds of any new theoretical concepts of factors of production and this is an evidence of timeliness of the selected topic.

Taking into account the present research topic, such problems like high technology resources analysis, their specifics, uncovering any changes in the structure of social division of labor, interaction between national innovative systems and the world markets of high technologies are of immediate interest.

In the last few years situation on various markets both in Russia and in the world, apart from everything else, is marked by economic development of any peripheral countries and the resources competition is increasing as well. Conflicts of interests which not always can be settled by the market mechanism are showing themselves. Practical activity is calling for integrated approach which should be provided by new concepts of economic theories, in particular, by the theory of factors of production.

**The level of the topic development.** A considerable number of works of Russian and foreign scientists is devoted to research of factors of production, their impact on economic growth and development. In this area of knowledge history of scientific thought is writing from classical times and down to our days. If one retrace formation of theoretical foundation of our research basing on levels of analysis, recognizing works of classics of economics, it is possible to find that on macro level the basic modern ideas have been formed in works by S. Kuznets, J. Keynes, G. Solow, V. Leontief, R. Barro, P. Krugman. It is worthy to mention a renowned Cobb-Douglas production function and the later theory of total factor productivity.

In the thesis papers concepts of the following scientists, well-known for their works in institutional analysis of enterprises and branches activity, have been used: F. Knight, D. North, J. Buchanan, S. B. Avdasheva, A.E. Warsawsky, O. G. Golichenko, V.E. Dementiev, D.S. L'vov, R. M. Nureyev, A. Radygin, P. Romer, A.E. Shastitko, etc.

Certain problems relating to problems of economic development with

due account for strategic role of human capital assets have been settled in works by O.S. Vihanski, R.I. Kapelushnikov, A. L. Kuznetsov, L. P. Kurakov, B. Z. Milner, V. I. Nekrasov, T. M. Orlov, S. M. Pjastolov, J. Heckman, O. A. Romanov, R.M. Entov, etc.

However in the addressed academic publications the author failed to find out any comprehensive representation of parameters of converged economic systems with due regard for current features of factors of production designated, among other things, by regional, historical, institutional features.

As it has been found out in the course of investigation of the sources, the production functions after inserting in analysis any parameters of innovation-focused investment activities are not adequately investigated. Taking into consideration creative and synergetic components of the production processes, new results of scientific research in this direction are expected.

**Goal** of the thesis work is to generate a comprehensive view on development the concepts of production factors of innovative economy.

**Target** of the research includes scientific notions and concepts formed and developed within the category of production taking into consideration special features of the innovation sector.

**Subject** of the research includes economic contacts in the knowledge-intensive sectors of economy designated by categorical features and linkages with production factors.

For to achieve the stated goal the following **tasks** have been set and settled in the thesis work:

- historical development and the present-day modifications of the theories of production factors in foreign and domestic scientific thinking have been investigated;
- the objective preconditions for formulation the present-day concepts of production factors in national innovative systems have been identified;
- modifications of production functions, examples of their application for explanation and forecasting the development of economic situations in the age of technological mode change, development

of knowledge economy and in view of signs of a crisis have been considered;

- the inter-country comparative analysis of methods and results of the state research and development in terms of factor productivity has been carried out;
- the strategic options of the innovation policy of the government of the Russian Federation with due regard to factor comparative advantages in the sphere of scientific and technology have been detected.

**Methodological foundation** of the thesis work includes methods of categorical, comparative analysis, mathematic economic model, systemic analysis, classification, grouping as well as principles of dialectical logic that allowed viewing all phenomena and processes on the move and with reference to each other.

**Scientific novelty** of the research is in foundation of theoretical frameworks and development of new approaches to analysis of resources and production factors of innovative economy.

The author himself obtained and proposed for defense the conceptual provisions of the thesis research which are of adequate degree of scientific **novelty**, and these provisions include:

1. The objective preconditions for development the present-day concepts of production factors of national innovative systems has been recognized; It was elicited that the concept of factorial income is relative and its importance, to a greater extent, is defined by the dominate paradigm; in particular, it was defined that a natural resource rent in the modern sense of the term is not a rent in the ordinary sense of the word as it is basing on a complicated finance facility in which the alternative costs of the whole national economy have been added.
2. The concept "throughput capacity" within the concept of economic growth which is moved by innovations and described by the model of biological production function has been specified.
3. Demonstration that the conventional factor theory and "the theory of total factor productivity" have no sufficient explanation to such phenomena, as phenomenon of "Asian miracle"; for to research



such phenomenon synthesis of "investigation of science policy and innovations", the theory of national innovation systems, is necessary.

4. Rationale for soundness of a hypothesis for statistically significant influence of political structure on processes of innovative development has been given. On the back of cross-country comparative analysis it has been demonstrated that the level of applied innovative activity (i.e. a number of patents) is the highest among the countries possessing the governmental corporatist national political framework, and the innovative activity in the sphere of fundamental researches is the highest among the countries stamped as social corporatist structures.

5. It has been found out that promises for the development of innovative-oriented economic systems are showing not as a result of search for any ways for allocation of any rare resources, but by settling problems relating to creation new types of resources; such as net resources.

**Theoretical significance** of the work is defined by the fact that the fundamental theorizes and conclusions contained in the thesis work, are contributors to the theory of factors of production of innovative economy which provisions can be applied as a methodological basis for settlement problems of factor supporting of innovative development of Russian economy.

On the grounds of critical comparative analysis of experience of innovative development in various countries, the recommendations for methodological grounding the development of political institutional measures of stimulating innovations in Russian economy have been received.

**Practical effect** of the work is defined by soundness and applicability of the drawn conclusions and made recommendations, by possibility to use of the obtained theoretical and methodological provisions, methods by industrial entities, by educational and scientific organizations when settling the problems relating to generation of effective system of innovative development. The suggested approach to definition the categories of production factors of innovative economy can be

used when setting the investments for to assign social and economic efficiency of innovative projects.

The basic results of the work can make a base for further development the methodology for organization the innovative activity in economic systems, and, as well, there are proposals to use them in the teaching and learning activities in studies of "Theoretical economics", "Innovative economy" in higher educational institutions with the speciality in economics.

**Reliability and validity** of the basic results and conclusions of the research are due to:

- well-founded selection of methodological and theoretical background to research of innovative activity in economic systems;
- reliability of sources of empirical and theoretical data;
- use a complex of methods and techniques appropriate to the subject and tasks of research of neighborhood effects of the innovative process;
- science-based generation of the research structure, the evidential base and conclusions.

**Evaluation of the research results.** The proposed provisions of a new methodological approach to definition and assessment of neighborhood effects of innovative process have been discussed and approved in the course of All-Russia training conferences "Modern Russia: Economy and the State" (2012) and "Current problems of development of economic systems: Theory and practice» (Moscow, 2011).

Results of the thesis work found their application in the teaching and learning activities in lectureship, in practical studies with participants in a course and postgraduates in the subject "Innovative economy".

**Publications.** The basic theoretical and methodical provisions of the thesis work have been represented in 5 published scientific works of the author, which total page count makes 2,6 printer's sheets.

**Structure and content of the work.** Logic and structure of the work, which consists of introduction, three chapters, conclusion, reference list and supplement, have been destined by the goal of the research. Content of the work is developing in the following sequence.

## Introduction.

Chapter 1. The classical base of the theory of production factors and its change in the context of modern economy

1.1. The milestones of generation of the factor theory in works of classics of political economy

1.2. Problems of formation of the production function for innovative economy

1.3. Generation of a new area – innovative development science.

Chapter 2. Empirical grounds of the theory of total factor productivity and its alternative

2.1. Attempts to explain “the Asian miracle” by the factor theory. Theses by P. Krugman

2.2. Discussions about factors of economic development

2.3. Significance of political infrastructure in innovative economy

Chapter 3. Potential of the concept of network structure in innovative economy

3.1. Production function in the concept of technological modes

3.2. Background to synthesis of theories about production factors

3.3. Institutional enterprise as a factor of network production actual for innovative economy

Conclusion

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## **The main content of the researches**

### ***1. Research of historical development and present-day modifications of the production factors theory.***

The presupposition of the research lies in the fact that the accepted taxonomy of production factors makes one of the governing parameters of the economic paradigm. As a result, it is expected that when the shared sense of characteristics of the economic system is changing, there should be certain changes in the factor theory. So, if there is a generation of "innovative economy", it is noteworthy what impact does changes in production relations have on generation of income commonly referred to "factor income".

Traditionally this problem is high on the list of economic theories. Basically, there is little doubt that when A. Smith created his models of economic system, he concerned himself with this problem more than with others. A. Smith countered the feudal hierarchy with market exchange, which as he chose to believe, gave equal rights, and which, as the great Scot believed, produced a fair income. And, in Smith's opinion, bad or unfair income has been produced by rent, i.e., values which, by virtue of political causes or legal standards are worthy than the market one, for example, a feudal rent.

That way, the theories of profit distribution in terms of ownership of property factors and these factors cost on competitive markets satisfy the questions what are specific nature and problems of definition the rents on land, rate of labour payment, interest rate for capital assets

According to G. Tullock, any rent is result of earlier investments. This is a result of allocation of efforts and assets in future value of benefits. For example, as regards energy, the problem is that sometimes the energy falls into category of resources. Probably, it would be sound practice to divide this energy by kinds of assets which should be understood as the investment product, in the form of electric energy, prepared for use, and raw materials as a natural resource. But the problem is that the same raw materials in underground have got no market value and cannot generate any revenue if failed to be mined after prospecting. In

this regard a fair question is arising: whether the traditional taxonomy of production factors under which the land itself, which has no value as the capital if no labor efforts have been applied to it, considers as the income source, is correct as a whole?

Marx indirectly considered the natural factor in creation of a new value though A. Smith in his immoral work, rather flabbily, mentioned just the natural factor as the reason for development the production factors and taking the natural component of value out of the production factors system.

D. Ricardo found the way which neither Smith, nor Marx, nor Say succeeded to find, only physiocrats took a step closer to understanding the problem: cost of labour does not depend on its demand and supply but on possibilities of national economy to provide to workers the necessary volume of physical assets. So, Ricardo, holding true to liberalism, partly removed the price formation from the market power, by demonstrating priority of environmental and geographic factor. However there is one resource in the Ricardo's theory– grain. Most probably, Ricardo considered the grain growing as the only relation between economy and nature in an effort to ease the economy model he generated.

As a matter of fact, the production factors productivity theory created by neo-classics is basing on marginal ideas, so, there is a reason to go on at once to the Cobb-Douglas theorem, quintessential for the factor neo-classical model. The aspect which is important for the production factors theory – in the Cobb-Douglas theorem there is a constant ratio between compensation and capital, as it follows from the function and the empirical observations which have been made later for its argumentation for the longer periods of development of American industry.

From this concept it is results that marginal products of labour and capital have no impact on their ratio in the production process. This conclusion can hardly be called a statement of phenomenon; it's most likely that the function described an actual state of things in production. The natural resources are beyond the scope of the Cobb-

Douglas theorem: limited capacities of extractive industries are holding rapid spread of natural resources consumption.

As the modern neo-classical school declares, a land has an absolutely inelastic supply as its volume is fixed. Like classics, P. Samuelson and other representatives of mainstream, are basing on pre-classical definition of land as the production factor, i.e. ground. But subsoil is falling out of this neo-classical theory of treatment an earth which currently is indemonstrable. Our logic suggests that mineral deposits can also be rentable if the reserves have been known. A land if it has not been cultivated cannot be involved in production. The following appears: proposal of land as the production factor will be elastic if we include subsoil in it. Response of obvious or prospective owners to growth in the resource demand can have a form, for example, of extension of mining operation and exploration activity. Under the circumstances when all reserves are already known, certainly, any proposal of land as a production factor will be inelastic.

As regards the production factors theory, any proposal of natural resources – “land”, traditionally increased: any exhausted and less effective resource replaced by more effective and less affected by consumption resources. By the example Russian (in the recent past Soviet) economy we can retrace how macroeconomic system has been transformed by production and consumption of energy. In fact, in this section we are to answer the following question: how the energy price can be determined and who pays for it? Open disregard of this question results in a wrong understanding of national economics’ development. The Russian experience shows us an important tendency in development of the whole world economy: there can be a plenty of “land” as a production factor, but its development can bring the macroeconomic system into a stalemate and for decades one should make a search for remedies if any. By the example of Russian economy of the recent years we can say that the resource rent is not a rent in the ordinary case of the word, as it is basing on a complicated finance facility, which, as well, includes the alternative costs of the whole national economy, for example, credits which failed to be accommodated in other economic segments. This data indicate that the question concerning the nature of energy as a

resource is still open as well as a taxonomy of production factors.

According to the neo-classical theory within which, in principle, the theory of “intellectual capital” is developing, the last-mentioned is considering as a special means of production which owner is any bearer of knowledge or skills. Just he gets “profits” from these means of production in the form of very high wages. A well-known theory of “three factors” in the modern neo-classical economic theory found its continuation in the concept of Total Factor Productivity (TFP).

However, in opinion of a number of experts, the concept of total factor productivity is leveling a human capital function, reducing its importance for economic development as the importance of such parameter, as labor productivity, is decreasing.

## ***2. Research of production functions modifications, examples of their application for explanation and forecasting the development of economic situations.***

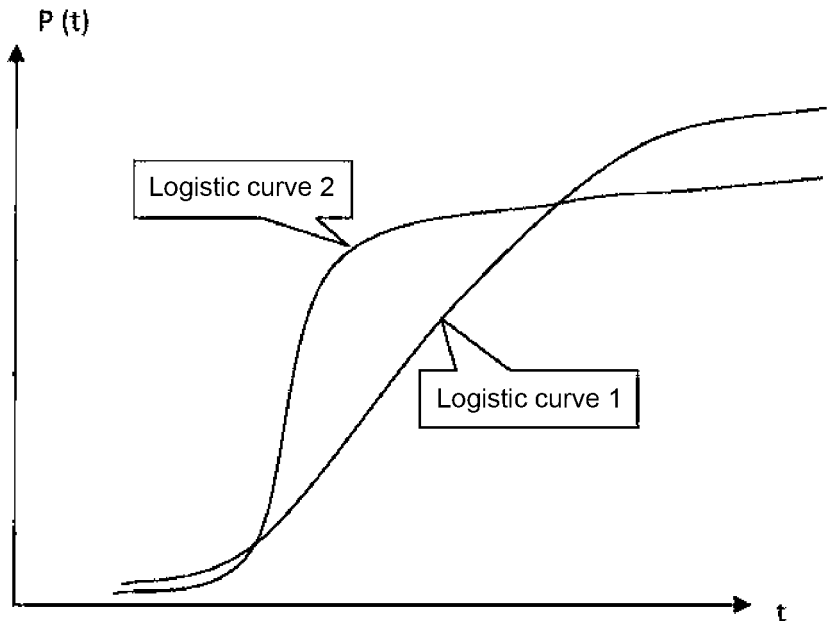
The modern research workers are again referring to the classical problem of definition and calculation the production function but now for its application in innovative economy. In the context of effectiveness of innovations the optimum is defined in terms of production capacities, and effectiveness is a technical factor. Within this framework the effective national innovative systems are functioning at the boundary of production capacities of their technology or "the production function curve".

At the same time, experience of innovative development in various countries shows that, for example, currently many Asian economic systems (developing countries) are moving along the trajectory which is far from the classical trajectory of the growth function which depends on labour and capital. Probably, this indicates the increasing efficiency of investments in science and technology. As well it can be explained by properties of knowledge, which, as a production factor, exhibit characteristics of increasing return. In this regard there is a term level of functionality development (LFD) of economic systems with self-sustained growth of science and technology, and researches of its stability are carrying out. LFD is an ability to improve the process of production of goods and services by innovative way. Within the LFD conceptual model, stability and time of its appearance in science and technology is approximating by a number of scientific publications and patents. The research has been carried out on the grounds of samples of Asian developing economics (the sample group includes South Korea, Taiwan, Singapore, China, Malaysia and Thailand). The methodological basis for measurement stability and time of FD is a bi-logistic function of growth which helps to display behavior of the system with two consecutive logical processes of growth, and each set of the growth factors is reflecting by simple logical functions.

This makes it possible to model systems which are showing two S-type growth curves where time series can be divided into two growth modes,



and each mode is represented by a simple logical growth function (Fig. 1). Science and technology production are generated by the strength of “pushing” and “market forces”, and when these forces are decreasing, the combined function value is approaching to the critical value which we are proposing to call “capacity”. At this stage the growth comes to a halt. Proceeding from this reason, the degree of functionality development can be defined as the relation between “capacity” and the production level, which, at the result, makes a function decreasing with time.



*Fig. 1. Bi-logic function of economic growth moved by innovations*

When developing, the theory of innovative systems gets to non-linear perspective which is more suitable for formation of innovation policy. However such models as bi-logic function of economic growth moved by innovations are underdrawing the process subject to research as they failed to take into consideration all factors. Under that logic, if one moves in this direction the form of the production function of innovative economy should be multi-logic. And, in case of successful selection and

realization of the innovative development strategy, the growth rates of such function should be non-decreasing.

The assessment of innovations effectiveness helps to identify the best practitioners in the innovative sphere for to clarify methods of improvement value and to reveal weaknesses in this sphere. In practice of innovations management, in the countries striving for operation under any strategy, currently paradigms of "the best methods" are applied. Such ideal structures are focused on the process of transformation of physical elements of national innovative system (NIS).

In the comprehensive NIS model the bottom-up (BP) and the top-down (TP) processes have been extracted; there are proposals to measure the following parameters at the inlet of the BP process: number of scientists and engineers in ETE; R&D spending in each country, measured as sum of various expenses made for to receive scientific and technological innovations; mental vocabulary obtained earlier and generating the upward stream of new knowledge. As a matter of fact "today's researchers are standing on shoulders" of the previous ones".

There are proposals to measure at the inlet of the BP: mental vocabulary obtained earlier and generating the downward stream of new knowledge (commercialized intellectual product); labor power in ETE necessary for economic activity in other spheres of national economy.

In the capacity of BP process' production in outlet it is necessary to consider: international scientific publications. We would like to note that technological production is more suitable for NIS assessment, and the number of scientific publications can be considered as final noncommercial production, and its assessment can be accepted as any intermediate product which, in turn, is a resource in inlet in the downward stream. Obviously, any scientific innovation is a source of technological innovations; however the process of transformation of any scientific product into technological innovation, as a general rule, takes a good deal of time.

In the capacity of TP process' production in outlet it is necessary to consider: the added value of industrial sectors in each country. And this is the main contribution of technological innovations in production of national product; export of new products in high-technology industries.

As well environmental factors include provisions for structure and infrastructure of innovations:

- quality of protection of intellectual property rights;
- regulatory of technological development and innovations;
- openness to foreign trade and investments;
- private financing of research and advanced development;
- scope of universities' studies;
- rate of venture capital;
- cooperation of universities and industries;
- level of cooperation of enterprises in technology.

When analyzing the current state of Russian economy, one can notice that enterprises have an active influence on formation of institutional environment. They are acting through actors ("financed" lobbying groups and officials) and, consequently, are institutional businessmen (not in the best sense of this term).

Enterprises, as agents of institutional innovations, are to make a choice between alternative behavior models, strategies, providing them an expected utility to the greatest possible extent. So, any modern enterprise can choose: to fit themselves to existing restrictions or to invest in changes of set restrictions.

While developing this concept for scientific organizations, we will venture to affirm that institutional business activity is one of the most valid system methods of innovative development of organizational structure within the concept of "economy of knowledge".

### ***3. Synthesis of “scientific policy and innovations researches” and theories of national innovative systems.***

The line of research named as “Science and technology researches” (STR) has been generated in science as a reflection of expansion of knowledge-intensive types of activities in economy. In parallel with this direction of development, the development in the area relating to research of policy in the area of scientific researches and innovations (RPSRI) is proceeding. The formed definition of RPSRI runs like this: “researches oriented to analysis, understanding and effective application of results in economy, policy, managements, for settling organizational, environmental and other challenge based on development of innovations, technologies, IR and science”. This definition includes lots of associated actions relating to creation of knowledge (by means of scientific researches), diffusion and acquisition of knowledge (for example, by means of organizational training) and its use in the form of any new or improved products, processes or services.

This definition is rather comprehensive, but the essential point is that the matter described as innovations of conditions, technologies, IR and science, is being discussed by application, among other things, a wide range of humanity subjects (economy and economic history, strategic researches, management, organizational researches, sociology, etc.).

The other key line of formation of innovative development science is the area of research of national innovative systems. The concept National innovative system (NIS) has been introduced into scientific use at the late 1980s (Freeman, 1987; Dosi et al., 1988) and has been developed in the following years (Lundvall, 1992; Nelson, 1993; Edquist, 1997). Currently it is in general use both in academic contexts and in the contexts of formulation actions of innovative policy, besides, as it enhances the understanding of innovation processes and their determinants, it considers to be useful and promising analytical tool of scientific research. Though up to now there is universally accepted definition of NIS, there is a semantic kernel common to the majority of applied definitions.

As commonly realized, NIS is forming in interaction of the innovative process (IP), engrained characteristics of environment; it is presented by conditions of structure and by infrastructure, by parameters defined by government interventions. In the context of its physical structure, NIS is a number of associated institutes and economic agents (for example, universities, industries, government authorities) which are making knowledge and carrying out innovations. These agents are forming a production basis for national innovations inside which the government is exercising its influence on the innovative process.

It is important to emphasize that if within the frameworks of classical and neoclassical approach the problems of economic development are considering as the problems of effective allocation of available resources, then, in the context of synthesis of STR, RPSRT, NIS theories, a problem of new resources *creation* comes to the fore.

In this paper we are making more specific the definition of the concept of NIS functionality<sup>1</sup>, by means of it abilities to improve production of high-technology products taking into consideration self-simulating (synergetic) growth of such production are studied. The phenomenon of self-simulating growth makes the basis for new approaches, new areas in technological innovations science, and the higher degree of development of functionality is indicating the higher potential of economic growth.

In this thesis work the author formed a rational for the thesis that the phenomenon “the Asian miracle” can propose a synthesis of “scientific policy and innovations researches” and theories of national innovative systems.

The experts are using four-composite typology of national political structures which creates a space with coordinates: social organization (state – association), collective agent (public – state). As a result, there are four political and institutional archetypes: national corporatist, public corporatist, liberal pluralistic, state – nation (Fig. 2).

Results of the research show that the level of applied innovative activity (i.e. number of patents) is the highest among the countries with the state

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<sup>1</sup>Functionality is an ability to improve processes of production of any goods and services by any innovative way.

Social organization	Corporative	public corporatist	national corporatist
		High level of innovativeness	Mean level of innovativeness
	association	Liberal pluralistic	State - nation
		Mean level of innovativeness	Low level of innovativeness
		Social form	State form
		Collective agent	

*Fig. 2. Typology of institutional structures of national economies*  
 corporatist national political structure, and the innovative activity in the sphere of fundamental researches is the highest among the countries described as social corporatist structures.

Research of distinctions in the sphere of fundamental researches hereafter shows that the social corporatist countries are carrying out much more fundamental researches, than three other political structures. However, among these three structures, the liberal pluralistic countries demonstrate the lowest number of the distinctions on levels of fundamental researches which have been found in the social corporatist countries. There are really posterior analytical distinctions in levels of fundamental researches between liberal pluralistic structure and other political institutional structures and they showed that the volume of fundamental researches in the country – state and in national corporatist structures is much less than in liberal pluralistic structures.

It seems that these distinctions assume that participation of government in innovative activity in the country, national features, can limit the scope of fundamental researches in these countries.

Results of this research imply a new contribution to the theory of various descriptions of capitalism and assume that while the governments are free to choose various policies for supporting the innovative activity within their competence and borders, probably, the best results can be reached by taking into consideration special features of the institutional environment. For example, any country with relatively low levels of innovative activity, and desiring to apply the policy, producing a desired

effect in the country with a high level of innovations, but with other political institutional structure, can meet with the strategic discrepancy of its institutes with the chosen type of innovative policy.

In this regard we would like to notice that currently the experts are suggesting a new phenomenon: "a global civil society". A new type of net-based communications is a new type of social and economic system where knowledge is a production factor in addition to labour, natural and capital resources. The share of "knowledge-intensive" services, besides the educational system and the staff training, is increasing in any other branches as well.

Not just information, but "the network logic of its basic structure" makes a core of the new form of communicational organization of the society. A network as the system of decentralized control gets the most important significance, and this is showing itself through functional tasks realized by it. Within the network power-information is generating more actively than to other organizational structures.

Technical, economic, political, cultural special feature of power-information may be explained by the fact that it not in as objective as "product" is. Both information and knowledge are of another nature as compared with the previous symbols of economic power. If the land supply is relatively limited, as well as the capital supply, knowledge can be accumulated and made without any restrictions. The budgetary constraints as the concept, demands a new development in this regard. The user knowledge is affordable not only by those possessing the power and money, and this is its revolutionary characteristic. A process of loss of monopoly for knowledge and distribution of intellectual technologies is observable in contexts of onrush of scientific and technical progress.

It is also possible to speak about a new type of dependence of capacity level from production factor and power information acts in our case as such factor. This factor, in contraposition with the traditional ones, has no attribute of diminishing return. It is also obvious to an adequate degree that the man of the hour uses already the whole planet as a whole as a natural source of items of assignment: its terrestrial surface, atmosphere, water resources and subsoil. The progressive scientific community warns us about crisis in the relations of type "planet – human being".

In the last decades joint efforts of developing countries being characterized as the emerging economies directed on transformations their industrial economies into post-industrial, knowledge-based ones, are evident. Science and technology up- growth, development of national innovative systems is necessary to support this economic strategy of transformation.

Assumed ability to extension of stages of rise of industrial cycles of recently industrialized economic systems (RIES), including those of South Korea, Taiwan and Singapore assumes essential transformation of their innovative systems thus resulting in higher efficiency while other developing economies, such as China, Malaysia and Thailand could not demonstrate essential changes for these years. According to the results a supposition can be made that RIES succeeded in leaving for the new growth paths, which realization would be possible under condition of transition to the knowledge-based economy.



#### ***4. Cross-country analysis of methods and results of implementation of state scientific and technical policy in aspect of factorial productivity.***

The generalized conclusion according to available observations of economic experience of 40 developing countries of Asia, Africa and Latin America is that economic development along with the intensive use of traditional production factors is accompanied by essential "order transformations", i.e. by transformations of institutional structures. Thus admitting that an obvious sign of economic development is the basic change in the sectorial structure of the production known as "structural transformation" and meaning the growth of a share of industrial production and the respective decrease of the share of agriculture in the full employment and GNP.

An additional point is that the special attention is deserved by dynamics of the indicators characterizing knowledge development of intensive sectors. For a decade (1996–2007) the growth rates of researches and development (R&D) of matured knowledge - intensive economic systems were lower, than those in the developing countries. Spending spree for R&D in the USA, EU and Japan varied between 5,4 % and 5,8 % while this indicator was about 9,5-10,5 % in Singapore and Taiwan and 12 % in South Korea.

The preliminary conclusion consists in the supposition that the countries should no more possess "traditional" resources to have possibilities to be built in into the global economy. Possibilities become less "predictable" in terms of calculation of classical production functions and production mode concepts. The economic success becomes more dependent in this situation on flexibility of thinking of corporate managers and politicians: they should find a suitable place and time, where and when to be built in into dynamic system of production and realization chains.

A recipe for success of "Asian tigers" consists namely in the fact that they managed fast and effective switching from one strategy of development to another one. In reply to change in global demand they managed to expand their production of the export goods, having made it based on knowledge, instead of on traditional resources.

Results of comparative international researches assume that the top-down process of commercialization of knowledge plays statistically more significant role in strengthening of innovative ability of NIS, than the bottom-up process of production of knowledge. These results confirm crucial importance of commercialization in innovative processes and also single out why the model of cooperation between university and industry plays a key role in development of effective national innovative system.

Such countries as the Netherlands and Great Britain being the followers with relative lower levels of TP and BP should concentrate on improving two components of innovative process. If these countries only increase volume of resources at the point of entry of innovations, neglecting efficiency of a process, it will make limited effect on results. If these countries increase their efficiency, their production and results of innovative processes can be improved with no necessity of additional investments at the point of entry of innovations.

For the majority of the countries whose indicators of innovative activity look differently, the innovation policy should be a stage-by-stage one. The countries with relatively higher level of BP but smaller efficiency of TP (for example, Canada, Finland, Japan, Korea and New Zealand) should stimulate the innovations managed by the market, develop the system of venture financing, platforms of information exchange to facilitate access to patents and to stimulate demand for innovations. The countries with lower level of BP, but higher efficiency of TP (for example, Italy, Mexico, Norway and Portugal) should strengthen the protection of intellectual property rights to stimulate the innovations; they also should improve arrangements for distributing the information, financing and resource support of researches and development.

Thus, the general recommendation is need to coordinate the development of strategic tools of innovation policy with taking into account various roles of intermediate technological products in BP and TP processes. The more accessible will be knowledge and the intellectual products promoting growth of bottom-up innovative streams, the better will be also a reverse effect – strengthening of top-down streams, i.e. commercialization of innovations.

## **Main conclusions and recommendations**

1. Roots of problems of modern taxonomy of factors of production lie among other issues in processes of “washing out” of private property concept, typical for post-industrial and, in particular, for information economy. Therefore definition of the production factors based on the income type classification appears to be inadequate to the economic realities.
2. Production function of innovation economy appears to be multi-logistical one and defined not only by the parameters of bottom-up and top-down innovative processes, but also by the institutional and political factors of the environment.
3. The traditional factorial theory and “the theory of the general factorial productivity” do not offer an adequate explanation to such phenomena, as the phenomenon of the “Asian miracle”; a unique model is needed for receiving forecasts of innovative development of each several national economy.
4. A “throughput capability and measure of development of functionality” criterion is proposed for use as a planning and monitoring tool for the innovative policy.
5. If the problems of economic development are considered within a framework of a classical and neoclassical approach as a problem of an effective allocation of available resources, that, from the point of view of a synthetic comprehensive approach, the problem of *creation* of new resources of innovation development should come to the fore.
6. Paramount importance for the solution of problems of innovation development is gained by resources having network character: infrastructure, communication patterns, and depersonalized confidence.

## **Main publications on the subject of researches**

A total of 25 scientific papers, including one monograph and some fundamental dictionaries and handbooks in a co-authorship have been published by Ugaslov N. F., such as:

1. *Unabridged economic encyclopedic dictionary.* – Moscow, 2011, 1200 pages.
2. *Unabridged encyclopedic economical and legal dictionary.* – Moscow, 2013, 1200 pages.
3. *Education and management: Dictionary and quick reference handbook.* – Kazan, 2014, 448 pages.
4. *Economy, management and Law: Dictionary and handbook.* – Moscow, 2014, 707 pages.
5. *Ecology, economy and right: Dictionary and quick reference handbook.* – Moscow-Kazan, 2014, 1000 pages.
6. *Social sphere: Dictionary and quick reference handbook.* – Moscow-Kazan, 2014, 432 pages.
7. *Finance and credit: Dictionary and handbook, Moscow-Kazan, 2014, 1104 pages.*

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*Nikolay F. Ugaslov*