Draft of Chapter I. Theoretical and methodological bases of innovative systems generating

1.1. Innovations as a basis of intensive development of regional economy

Innovations are the main motive power of manufacture and society development during an epoch of intensive scientific and technical revolution. They make a basis of competitiveness of firms, branches, regions and countries and they are a necessary element of any reproduction process.

In the domestic and foreign literature devoted to studying of innovative activity's problems, various sights at the essence and meaning of innovations and innovative processes are traced.

N.D.Kondratyev and J.Shumpeter are considered by rights the first theorists of innovative processes. *N.D.Kondratyev`s* theory of «the big cycles» proves the fact that dynamics of economic structure of a society sensitively reacts to the base innovations bringing about realization of secondary, modernizing social and economic innovations. His basic ideas were developed *by J.Shumpeter*. Still in 1911 he noticed possibilities for the accelerated overcoming of economic recessions through activization of radical technological changes in innovations. Later, in the 1930s, J.Shumpeter introduced a definition of an innovation, treating it as change for the purpose of introduction and use of new kinds of the consumer goods, new manufacturing resources and vehicles, the markets and forms of organization into the industries.

At present a single generally accepted meaning of «innovation» is not defined yet. It is possible to mark out following treatments. Innovation is:

- change (J.Shumpeter, M.Porter, L.Vodachek, M.Huchek, A.I.Prigozhin, A.A.Rumjantsev, S.D.Ilenkova, L.M.Gohberg, etc.);
- process (J. Bright, B.Tviss, B.Santo, L.Zotova, O.Eremenko, V.N.Lapin, Z.P.Rumjantseva, N.A.Solomatin, V.A.Balukova, I.A.Sadchikova, M.Todaro, etc.);
- activity (U.Bell, J. E.Shtajner, N.Lin, J. Zaltman, etc.);
- result (D.I.Kokurin, I.T.Balabanov, R.A.Fathutdinov, G.D.Kovalev,

A.B.Titov, M.M.Shabanov, V.V. Mishchenko, etc.);

ü novelty (I.Bernard, ZH.-K.Colly, B.A.Riseberg, E.B.Starodubtsev, L.SH.Lozovsky, etc.).

In this work the definition given *by R.A.Fathutdinovym* is considered basic: «an innovation is a final result of introduction of a novelty for the purpose of change of management object and reception of economic, social, ecological, scientific and technical effect»[1]. Besides the innovation is understood as a subject, a way, a method changing sphere and environment.

An innovative process (IP) is a process of transformation of scientific knowledge into an innovation which can be represented as the consecutive chain of events leading to ripening of the innovation from idea to a concrete product (technology, service) and to distribution at practical use. During research evolution of innovative process (tab. 1) has been revealed.

Table 1

Evolution of innovative process's models

N	Model	Period	Characteristic
1.	Linear	1950s – 1960s	Innovative Process begins from basic researches in large research centers and comes to the end in the sphere of distribution and use of products. The market is considered as the consumer of results of technological activity of manufacture. It does not reflect all complexity of mutual relations of innovative process's participants, feedback mechanisms between them. It does not consider external conditions and the ideas which have appeared out of mentioned research division.
2.	Linear and consecutive	The late 1960s – 1980s	Innovative Process is considered as transfer of scientific and technical knowledge direct in the sphere of satisfaction of the consumer's needs. In many respects this model repeats the previous one, but the emphasis is laid on requirements of the market.
3.	Interfaced	1970s – the mid-1980s	This model represents a combination of linear and linear and consecutive ones. Connection of technological abilities and possibilities with requirements of the market is accentuated. It takes into account possibility of presence of external for the company sources of knowledge and innovations along with own researches and development and also feedback between innovative process's participants.
4.	Japanese interactive	The late 20th century	The accent is put on the activity of the integrated groups and on external horizontal and vertical connections. It assumes that simultaneous work is carried out on idea of several groups of experts operating in several directions. A necessary condition of parallelism is continuous environment of transfer of technologies in a combination with repeated processes of a feedback, i.e. an innovative infrastructure.
5.	Strategic networks	The early 21st century	New functions are added to parallel process - conducting research and development with use of the modern information technologies with which help strategic communications are established

[1] Fathutdinov R.A. Innovation management: Textbook. – Business school «Intel-synthesis», 1998

In modern economy all considered innovative process's models co-exist in various firms, branches, the countries.

Influence of innovative process on economy is just partially embodied in new products or technologies. More considerably it is shown in increase of economic and scientific and technical potential as preconditions of occurrence of new technics, i.e. technological level of innovative system and its components raises, thereby the susceptibility to innovations raises. Thus, innovative process is directed on creation of products demanded by the market (technologies, services) and depends on the social and economic environment in which it develops.

Innovative processes proceed in national innovative system (NIS). The «Origin» of concept of NIS concerns the late 1970s. Under the influence of this concept in the western countries the matter of scientific and technical policy has changed. Except its usual orientation on stimulation of knowledge manufacture by state financing, there was rather independent innovative component directed on development of demand for scientific and technical production, which is produced by state-private financing. In the NIS network the science and technology sphere is considered as a market version including manufacturers, sellers, distribution channels, consumers and prices. Largely this sphere is called not to go by supplier's functions but by demand.

Integrated innovative activity subjects and regulations form NIS (fig. 1.)

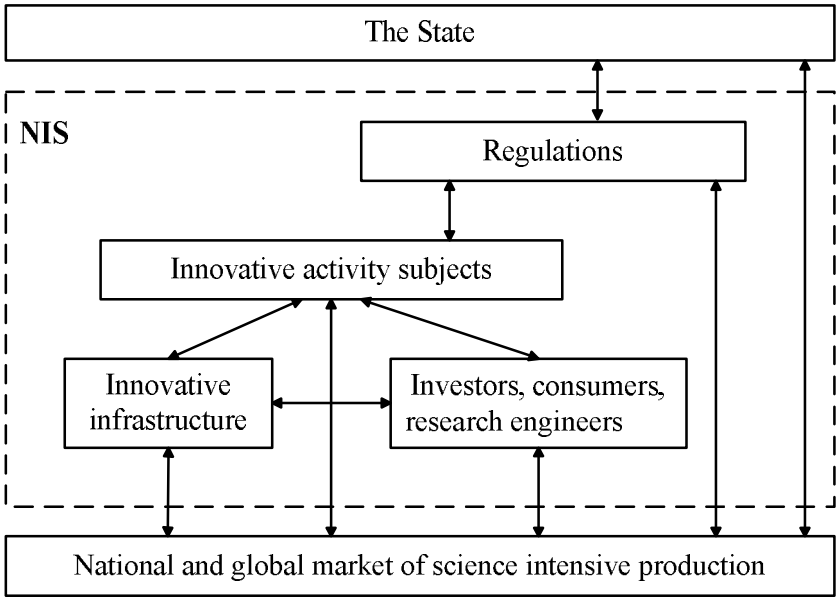

Fig. 1. NIS structure and system of innovative activity connections

NIS functions as system transforming knowledge into new technologies, products and services which are consumed on national or global markets.

Now in Russian legislative authorities NIS is interpret as «innovative activity subjects and objects body which are co-operating in the course of innovative production creation and realization and carrying out their activity in the network of policy spent by the state in the field of innovative system development[2]».

Under modern conditions creation of NIS can be considered as global strategic directive and essentially depends on a state political system. For transfer of our country economy into an innovative way of development it is necessary to create powerful innovative system which can provide innovative process activation. To provide achievement of the main strategic target of innovative activity – competitiveness of a national economy, NIS from the very beginning should be planned on mass working out and development of the advanced science and technology achievement.

NIS of any system consists of innovative systems of country's separate regions. Regional innovative system (RIS) functioning should be directed on realization of region competitive advantages at national scientific and technical priorities realization, assistance to regional economic growth, to transition of its economy to an innovative way of development.

There are three basic approaches to construction of RIS (tab. 2).

Table 2

Approaches to regional innovative system construction

The title	Approach essence
«Top-down» approach (traditional)	All key moments of regional scientific and technical development are defined at federal level. RIS elements, its functioning purposes and problems are rigidly subordinated to the national level purposes. Development Resources arrive from the federal budget.
«Bottom –up» approach	The region itself forms and carries out the scientific and technical policy and, accordingly, defines structure and RIS functions. Federal centre gives to region the right to establish priorities of scientific and technical development.
The project approach	It is characterized by realization on region territory of the concrete initiatives organizers of which can be both federal governing bodies, and regional and even local. Both scientific, and educational, and business structure can participate in the project and supervise over it. Financing and management restrictions are also conventional enough.

[2] The main policy directions of the Russian Federation in the field of innovative system development till 2010

The performed classification is not universal. Approach borders are indistinct; they practically cannot be meeting per se. The approach choice by RIS formation demands the complex weighed decisions and the account of various factors and conditions. For this reason innovative systems of various countries and regions differ.

Transformation of idea into production inside RIS (NIS) demands various resources expenses, the main of them are investments and time, participations in IP of various social and economic activity participants, such as the organizations developing innovations; the organizations functioning in the market of high technology production and the capital (investments); the infrastructure organizations.

Theoretical analysis of IP allows us to allocate the direct and indirect factors influencing its formation and development (tab. 3).

Table 3

The factors influencing regional IP development

Direct	Indirect
1. Competition Level 2. The Social and economic level of region development 3. The Level of science and technical development 4. Manufacture diversification, a choice of priority directions of development 5. Development of small innovative business, creation IIP 6. Volume of high technology production export-import 7. Innovative activity of region enterprises 8. A technical and technological level of region production 9. A population Educational level, highly skilled labour 10. IP security information resources.	1.Nature and climate environment - geographical position - natural resources specificity - climate
	2. The Social and economic environment - national features - level of the population's innovative culture - demographic situation - inflation rate - model of economic development - re-structuring of branches of regional economy - a state share of influence on economy - state-private partnership formation
	3. state and region policy - the innovative policy - the scientific and technical policy - the industrial policy - the financial and credit policy - the investment policy
	4. The innovative environment - individual freedom - completeness formations of NIS (RIS) - an innovative infrastructure - venture mechanisms of financial resources attraction - legislative base - the differentiated tax policy stimulating IP
	5. The international environment - integration degree into the international innovative networks - participation in processes of labor international division , specialization and cooperation in the field of scientific and technical and industrial activity - «presence» on the international commodity markets of high technology production

Every considered factor can affect innovative processes but, in our opinion, it is expedient to consider total effect of several factors influence or all simultaneously.

We consider that by the country transition into an innovative way of development under the conditions of transitive economy the state role is extremely important, which is to provide national strategy working out and realizations and mechanisms of innovative development. During the present research it has been established, that for innovation creation large investments, a long research-and-production cycle quite often are required, there is an uncertainty of an end result as well. Besides, there is often no direct dependence between the actual sum of investments and the size of the received profit in innovative sphere. Therefore there isn't enough investment into innovative workings out from private business, that can negatively affect the country competitiveness on the world markets of high technology production. On this basis the important conclusion in the methodological relation has been drawn: the problem of creation of effective state stimulating conditions formation for development of business and innovative activity, and also the environment promoting attraction of the private capital into innovation working out, promoting cooperation between the state and business, science and the industry has become most important. And only the partnership of the state and private business reduces risks in innovative activity sphere.

Consider how innovative process support is carried out worldwide.

1.2. Domestic and foreign experience of activation of innovative processes

Many developed countries of the world, the USA, Japan, Germany, Great Britain, France and other leaders of the world technological progress and also new industrial countries of South-East Asia and China follow to Innovative way of development, which technological development jumped during the last two decades. GDP of these countries by 75–90% is achieved thanks to «progress in knowledge», intellectualization of main production's factors. For some years past in Russia the measures are taken to form a System of Innovation, however

mentioned indicators amounted to about 10% only in 2003–2004. The further secure of economic growth for use account of raw resources is difficult and non-perspective. That is why the transition of country's economy to the innovative way of development is becoming without alternative and one of the most important national tasks. Russian community has realized this fact today.

The leading countries` economy is characterized by an openness, developed financial markets, legal, political institutes and infrastructures, labor market flexibility, involving into the international trading unions. Besides, the governments of these countries actively manufacture support and sell hi-tech production.

Nowadays we analyzed the innovative system of the Russian Federation and its region, Vologodskaya oblast, according to 3 blocks of indicators:

1. Indicators on the regional innovative system input: financing, personal (trained potential). 2. Internal indicators of RIS, describing institutional conditions, in the framework of which it functions. 3. Indicators describing the productivity of innovative system on exit: number of discoveries, patent applications, inventions and other. The analyses get to expose the following problems:

1. Number of the staff involved into research and development is insignificant. There is a deficit of processional innovative managers. In 2005 on the territory of the region only 464 persons conducted research work, or 7 persons per 10 000 of economic activity population. Analogous indicator throughout Russia is 110,7 persons. Number of the staff involved into research and development per population 10 000 in some countries of EU in 2003 was: in Finland - 110; in German - 58, in Spain - 36, in Poland - 20, in Czechia - 27.

2. There is not enough finance to conduct research work is the region. So, internal expenses for research and development in all financing sources per a scientific employee in Vologodskaya oblast in 2005 were: 10,5 thousand dollars and in Russia-16,8 thousand dollars. In the country of EU this indicator in 2005 was: in German - 118,7 thousand dollars, in Finland - 90,7, in Czech - 79,7, in Spain - 72,8, in Poland - 32.

3. A low level of innovative activity of the enterprises of the region. The level of innovative activity of Vologda Region is 7 %, in Russian Federation - 15 %, in the developed countries innovative activity of the enterprises is on the level of about 50 %: in German - 60,3 %, in Finland - 44,9 %, in France - 40,8 %, in Italy - 36,3 %.

4. According to statistic date no advanced production technology was developed by patent applications 9 in Russian Federation - 21. In the development countries this indicator on 2 - 3 orders above: in Finland - 4838, in Czech - 1560, in Spain - 624, in German - 376, in France 305, 9, in Poland - 246.

5. A low work's of efficiency of single mechanisms, appealed to stimulate cooperation between managing organization and scientific institutions and establishments of higher education. Researching of innovative processes in the region has show, that thematic of research works, conducted in the establishment of higher education does not coincide with priority direction of technologies development, realized by the enterprises. Some direction of interest for enterprise (processing and reproduction of houses, rapid construction and transformation of houses and other) have not become priorities for the establishment of higher education.

Thus, a place of the Russian Federation in world innovative processes according to its scientific and technical potential is not adequately available for it. Certain elements of NIS function out of communication with each other and with other sectors of economy. The Russian Federation essentially lags behind the West countries accordingly the development level of innovative process institutional tools. The transition from command to market economy has performed its part as «transition period» is characterized by institutional unevenness. Only the state is capable to accept long-term strategy on economy transfer into an innovative way here. In our opinion its influence on the further succession of events is the most important. The understanding of these facts demands from governing bodies the complex weighed decisions directed on situation change. Strengthening of a state regulating role, both on national, and on regional level is necessary.

Address to foreign experience of IP support.

In 1990s in the West European countries there was transformation of scientific, industrial, partially economic and regional policy into innovative which has got system character. The main aim of it was support which favour creation of innovations. In the second half of 1990s the governments of almost all West European countries have accepted programs of innovative activity stimulation, directed first of all on distribution of novelties. Institutional changes have occupied one of the basic places in realization of these programs. As a result the set of mechanisms has been developed with which help in the developed and new industrial countries of the world the state stimulates cooperation between the managing organizations, scientific institutions and high schools in innovative sphere, promotes a transfer of technologies, creates a favorable innovative climate.

The given mechanisms are realized within the limits of the active state innovative policy which includes a composition of various orientation measures, thus it is possible to notice, that each country has its innovative policy specificity. At present it is possible to allocate following directions of an innovative policy in the developed and new industrial countries (tab. 4).

Table 4

Innovative policy directions in the developed and new industrial countries

Direction	Specificity	Country
Optimization of national innovative system structure	Optimization of the state control and planning system in sphere of innovations	Japan, Norway, India, Chile
	Optimization of a science and innovative sphere state financing	The USA, France, Great Britain, Denmark, Norway, Sweden, Taiwan, Australia
	Development of basic researches	Great Britain, Sweden, Slovenia
Innovative cooperation stimulation of business and science (universities) inside the country	Symmetric rapprochement stimulation of universities and corporations	The USA, Finland
	Large state investments in a science and innovative sphere and the national private capital attraction	Israel, Finland
	Innovative activity stimulation of a private sector with attraction of foreign capitals in innovative sphere	Great Britain, Ireland, China, Korea, Malaysia, India, Israel
	Innovative initiative stimulation of scientific sector	Germany, Japan, New Zealand, Denmark
Integration into the international innovative networks	Complex integration	Finland, Israel, the Netherlands, China
	Technological specialization	Korea, Malaysia, Singapore, Taiwan, India
Internal innovative networks organizing	Creation of special conditions for communications in innovative sphere formation	The USA, Norway, Ireland
	Stimulation of the national regions initiative	France, Germany, Finland

Continuation Table 4

Formation of national innovative system	Re-structuring of a science state sector	Bulgaria, Poland, Lithuania
	Initiation of science and education integration	Latvia, Estonia, Czech
	Involving of small and average business in innovative sphere	Romania, Czech, Slovakia, Latvia, Estonia, Turkey, Chile
	Definition of priority export directions in the field of high technologies	Czech, Romania, Chile, Turkey

The experience analysis of the world leading countries shows, that effective innovative process is possible when there is:

– a connection between all its participants;

– the state maintenance of innovative process with a corresponding infrastructure;

– development and realization of the state innovative policy.

Growing necessity for cooperation is an objective process caused by the following factors:

ü technological products have become more difficult, therefore industrial firms have to conduct researches on more wide range of directions and it is difficult to act alone;

ü the competition compelling the companies to refuse vertical integration by conducting research and development grows in a globalized society and on a vast scale to pass to outsourcing;

ü both labour, and capital mobility has increased. Nowadays researchers prefer to change their job in search of the best conditions for creative activity, and the venture capital is alternative to financial resources of big companies.

For stimulation of these connections development in the different countries appropriate programs are realized, the necessary infrastructure is created. It is necessary to note the basic moments:

1. Multicomponent support of innovative activity is carried out taking into account regional features and the state priorities.

2. The state, participating in risk warranting and financing high-risk projects, compensates «market failures».

3. The state develops connections between science and industry through financing of co-operative researches and development till they are not competitors. Essential stimulus in such programs is a cession of rights to IS, created at the expense of budgetary funds, in the industry for its subsequent commercialization.

4. By creation of innovative infrastructure, it is important to build not only those elements which directly concern the sphere of science and technological manufacture. An «external» infrastructure – the condition of roads, airports, and other communications – should be attractive to potential investors.

5. In all industrially developed countries and especially in EU the huge attention is given to technologies transfer as it provides development of hi-tech business.

6. Small innovative business is a serious factor of STP acceleration thanks to creation of a real competition in innovative sphere.

The state participation in activization of innovative activity is the most important. As world practice shows, for creation of innovative economy it is necessary to involve such tools as the organization of partnership the state – business – a science; venture financing; formation of appropriate legislative base, tax system, and infrastructure. Moreover the active position of the state acting in a role of the subject, which direct and make active innovative processes is required. The weighed and provident state policy promotes development of a competition and such by creates new possibilities for business development. Thus, the purposeful state policy to provide high rates of innovative development in market conditions is necessary both in innovative and scientific and technical, and in social and economic sphere.

All this testifies to necessity of increase of state role for innovative processes activization.

1.3 The state role in a system of innovative processes management

When the economic system is under the conditions of institutional misbalance, the active position of the state acting in a role of the subject, directing and making active the innovative processes, creating appropriate infrastructure is required.

Hence, the author formulated requirements to the state regulation character of innovative processes which under the conditions of social and economic transformation system, should be consecutive, system, effective, flexible and meet the following criteria:

1. State regulation should be timely.

2. State regulation should provide creation of feedback mechanism with innovative sphere.

3. By regulating system formation it is expedient to use indirect methods of influence on innovative processes.

4. State regulation should promote decrease in economic differentiation of country territories.

5. The regulating system should correspond to existing innovative sphere.

We agree with *M.Porter*, that «the leading to success government policy is a policy creating environment, in which companies can reach competitive advantages, but not that by which the government is directly involved into the process[3]».

The innovative policy is one of the major factors influencing innovative process. In legislative documents it is treated as «a component of the state scientific and technical and industrial policy …[4]», and also «definition of innovative strategy purposes and mechanisms of priority innovative programs and projects support by public authorities and subjects of the Russian Federation[5]».

Experience of many countries shows it is impossible to develop the typical innovative policy, applicable for all states, regions. Results of rigid following

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[3] Porter M. Competitiveness. Translation from English. – M.: Publ. House «Williams», 2002.-C.194-195

[4] The main policy directions of the Russian Federation in the field of innovative system development till 2010

[5] Federal law «About the innovative activity and the state innovative policy « adopted by the State Duma decree dated 01/12/1999 N4685-II ГД

either theoretical concept under various social and economic conditions can essentially differ. The weighed and provident policy of the state should be built taking into account a current situation, own priorities, directions of territory development and adapted strange experience.

The analysis «the innovative policy» definitions presented to the domestic literature and legislative documents has shown that there are some divergences in treatment of all its components: the maintenance, essence, the purposes, objectives, principles. In most cases it is defined as management toolkit. We will notice also, that sometimes there is an innovative policy identification of the state or region.

Generalization and ordering of various approaches to essence of a considered category have allowed the author to draw the following conclusions:

1. The category «innovative policy» is rather «young» and has arisen in connection with requirements of the further progressive society development.

2. With local government development not only realization process, but also the process of innovative policy formation at all hierarchical levels arises inevitably. Meanwhile the innovative policy of each hierarchical management level is developed taking into account certain requirements and restrictions.

3. Innovative processes of corresponding hierarchical management levels are an innovative policy matter of issue. The subject is state governing bodies of corresponding levels too. The object is relations between innovative process participants and subjects of carrying out of a policy.

4. The innovative policy should have system character.

5. The innovative policy is one of the major factors influencing development of innovative process.

6. The regional innovative policy should be formed taking into account equation of national and regional interests.

An innovative policy is a set of the relations developing between authorities and subjects of the Russian Federation and subjects of innovative process concerning of organizational and economic bases formation of regulation of region innovative development. The regional innovative policy is a part of a social and

economic policy and provides the environment creation stimulating innovative process in the Russian Federation subject (fig. 2).

At specification of the given definition, the author recognized that it is necessary to expand the matter of «innovative policy» definition taking into account an active role of innovative process subjects and their interaction during innovative economy formation and development. In the offered approach the essence of an investigated category should be considered through interaction of innovative process subjects, therefore various aspects of relations between them should be considered.

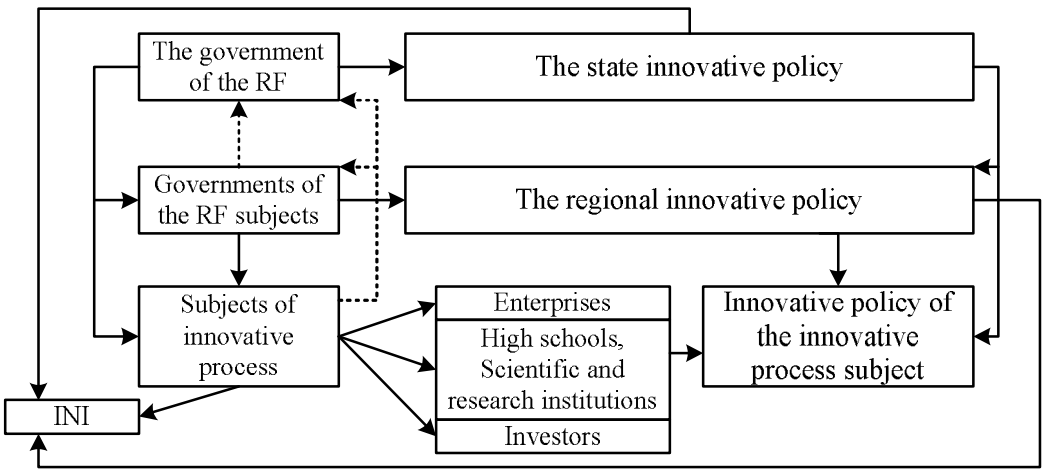

Fig. 2 Levels of an innovative policy

One of the major components of the state innovative policy is an innovative infrastructure formation.

Infrastructure elements are natural and objective generation of market relations, their value increases in process of development and perfection of these relations. The commodity market infrastructure promotes interaction between manufacturers and consumers, supply and demand. Efficiency of national economy functioning appreciably depends on this mechanism precision. It follows that the innovative sphere being a component of economic sphere and having own internal specificity, also should possess the infrastructure in which are inherent both typical, and specific lines.

During dissertational research it has been established, that in works of domestic economists (A.A.Rumjantsev, V.A.Gnevko, A.B.Serebryakov, D.I.Kokurin, K.I.Pletnev, I.G.Dezhnina, B.G.Saltykov), the innovative infrastructure is defined as a complex, set of the organizations providing conditions of subjects managing of innovative process. The similar treatment of this concept is given in legislative documents of the Russian Federations regulating innovative development sphere.

On the basis of the conducted researches the author draw the conclusion there is formation and development dependence of an innovative infrastructure on basic characteristics from national (regional) innovative system characteristics, and also from strategy of the state innovative policy. However irrespective of a state system type for stable and effective functioning of economy the infrastructure is necessary.

We consider that it is expedient to allocate following basic innovative infrastructure subsystems (tab. 5).

Table 5

Basic innovative infrastructure subsystems: functions and elements

The name	Functions	Elements
Subsystem of material and technical support	Industrial-technological support of new competitive high technology production and high technologies creation, their practical development	Techno parks, the is innovative-technological centers, is innovative-industrial complexes, technological clusters
The financial subsystem	Maintenance of innovative activity financial and economic support of, accumulation of investment resources for realization of innovative projects and programs, the financing process organization of scientific and technical activity on the terms of the program and goal-oriented priority approach	Various types of funds (budgetary, venture, insurance, investment) and other financial institutions
The social subsystem	Preparation of innovative managers for innovative projects realization management , disclosing and activization stimulation of researchers and developers creative potential, increase of the population innovative culture	The kouching-centres, high schools, the scientific and educational centers, high schools, institutes, academies, etc.
Information marketing subsystem	It creates possibility of data program and distribution about innovative sphere development directions , the market environment situation, new objects of intellectual property; the marketing, advertising and exhibition activity organization, patent and license activity and intellectual property protection; the high technology production certification	Libraries, information centers; technologies transfer centers, chambers of commerce and industry, high and information technologies exchanges, various telecommunication systems, mobile digital radio telephone communication, etc.

The analysis of allocated innovative infrastructure subsystems functioning in Russia has shown that, process of their formation in Russia under the conditions of a transition period from one economic system to another has begun spontaneously, without necessary state regulation. Often some of its elements appeared before innovative activity has received its development. As a result today there are serious misbalances in an innovative infrastructure creation. If in some directions the system is developed enough, on another ones the work practically is not begun. In the near future formation of such innovative infrastructure which will provide necessary resources balance of innovative enterprises, and also realization of reproduction conditions of innovative activity is important.

Thus, it is possible to draw following conclusions:

1. Strengthening of the state role in innovative activity management under the conditions of transitive economy expressed in working out of an innovative policy and formation of mechanisms of the innovative processes state support is necessary. One of the major directions of an innovative policy is infrastructure creation.

2. In Russia there are already many elements of innovative infrastructure. Now it is required to adjust them for work under market conditions. But there weren’t some infrastructure elements earlier and it is necessary to create them: the innovative and technological centers, techno parks, business incubators, transfer technologies networks, venture funds.

3. Federal authorities have large-scale influence levers on region enterprises and the generating knowledge sphere. Fiscal and administrative influence measures of regional authorities are limited by frameworks of their powers. By interactions with infrastructural elements, on the contrary, a role of regions is more considerably, than federal influence authorities.

4. The state can influence on national innovative system development by means of working out of various programs and the control over their realization.