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Innovative Ecosystem: a Model of Innovative Development of the Russian Regions

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Abstract--- *The objective of the present paper is to consider modern problematic situations in the field of innovative development of the Russian Federation and its regions, as well as to study the tools to eliminate the revealed problems. In the course of the research a problematics of a non-uniform innovative development of RF regions has been revealed. Solution to the situation can be concentration of efforts on the developed regions or formation of favorable conditions for the innovative development in all regions for the efficient operation of the national innovative system. In this case a rational tool is the process of formation of the innovative ecosystem of the region which is characterized by an optimal interrelation between the participants of the innovation process basing on the principles of self-organization and self-control. On the basis of the research conducted the unified model of the innovative ecosystem of the region has been formed, the adaptation whereof to conditions of a certain region will allow increasing its innovative activity.*

Keywords--- *Innovations, Innovative Development, Economic System, Regional Economy, Innovative Ecosystem, Regional Ecosystem of Innovations.*

I. INTRODUCTION

Under conditions of the world-wide socio-economic destabilization, the main factors of which became the instability of prices on the market of carbonic raw materials, escalating political struggle, and growing military and geopolitical conflicts, the issues of efficient economic development attain special role for the country. The level of competitiveness of the Russian business entities and of the state as a whole, and consequently the level of life quality of the population depend on the efficient mechanism for introducing the results of fundamental and applied investigations and developments to the activity. Upon implementation of the priority national initiatives in all spheres of the state activity, the innovative development and innovative potential of economy acquire great value. The process of efficient development of the innovation component is one of the main objectives of the state management of economy.

Particularly important is the process of establishing optimal systems that will stimulate the innovation process. These systems should comply with the model of innovative development "triple helix" and possess such important features as: self-development and self-organization. At that the processes of innovative development of regions play the pivotal role for the state development.

There are many efficient and worldwide renowned practices of creating and functioning of innovative systems: "Silicon Valley," MIT (Boston), Cambridge, Harvard etc. In these examples the experts identify an ecosystem

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approach in formation thereof, they based on when generating these innovation structures. That is why the study of innovation ecosystems of the regions seems important. It will enable to reveal the primary opportunities for the growth thereof and intensify the innovation process in the region.

II. RESEARCH METHODS

Within the frameworks of the research there was used a broad range of methods for scientific investigation that allowed conducting rather a comprehensive analysis and study of the subject. The applied research methods include comparison, analogy, simulation and analysis. Using these tools enabled to prove the concluded hypothesis and study the possible options of solution.

III. RESEARCH LITERATURE REVIEW

Presently many scholars in the area of economic development shift the emphasis of the research to the innovative sphere which is defined as one of the priority vectors of the economy growth. Innovations are the primary source of the economic growth for the developed countries which is proved by the examples of the USA, Korea, Singapore etc.

"The innovative development - is the development whereby the qualitative leap is ensured in the economic structure of the object with the use of its innovation potential" [1, p. 213]. The process of the innovative development of the state and its structural elements is of consistent nature that enables to qualitatively intensify the process of innovations commercialization. The scholars identify different levels of innovation systems within which there is a certain specific nature of management. In particular, the following levels are distinguished: national, interstate, regional, municipal and corporate. The regional level at that deserves special attention. The experts often distinguish a problem of a non-uniform innovation development of the territories which consists in the fact that such regions as Moscow, St. Petersburg, the Republic of Tatarstan and some other regions demonstrate high innovative activity, whereas the periphery territories act as the catching-up ones. This situation illustrates the imbalance in the economic development of regions, and consequently, differentiation of the life level of the population (salaries, social allowances etc.). The issues of development of the national and regional innovative systems in the modern economic science were actively studied by the following domestic scholars: Avilova V.V., Beketova N.V., Golichenko O.G., Glaz'eva S.Yu., Dmitrieva O.Yu., Elagina V.I., Zakharova V., Zinchenko V.I., Ignatova V., Lisovskiy N.V., Kondrat'ev N.D., Odinstov K.A., Pambukhchiyants V.K., Rumyantseva A., Saltykov B.G., Tkacheva S.V., Ulanova Zh.Yu., Fayzulloyev M.K., Yaremenko L.A. et. al. Foreign scholars made a great contribution to study of these issues as well: Armstrong H., Granberg A., Cook F., Kuklinski A., Nelson R., Porter M., Temple M., Freeman C., Schumpeter J.

Presently many experts begin distinguishing the ecosystem approach as a priority one in the field of innovative development of territories and economic entities. The approach consists in creating favorable environment for innovations commercialization and intensification of innovation processes.

The notion of the innovative ecosystem has been considered in the scientific literature for the last 10-15 years (Table 1).

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Table 1: The Notion of "Innovative Ecosystem"

The notion and author	Definition
Ecosystem (biol.) Tansley A.	Biological ecosystem consisting of the community of living organisms, their habitat, networking system; there is a constant exchange between them, substances and energy [2].
Business-ecosystem Moore G.	"...economic community basing on the foundation made of the interacting organizations and individuals, the organisms of the entrepreneurial world... The ecosystem of any enterprise includes consumers, market intermediaries (including agents and commodity flow channels, as well as those who sell associated products and services), suppliers and of course the company itself...But at the same time the ecosystem of any enterprise includes owners and other stakeholders, and moreover, ... governmental departments and regulation institutions, associations and organizations ensuring the compliance with the standards and representing consumers and suppliers. Ecosystems also include direct and potential competitors to some extent, as well as any other important members of society" [16].
Innovative Ecosystem (Russian Venture Company)	Complex of economic elements that interact with each other in the process of commercialization of innovations and their interrelations; at that human, financial and other resources are accumulated to intensify, optimize and secure the efficiency of innovations commercialization [3].
Innovative Ecosystem Moiseyev N.A., Akhmadeyev B.I.	Combination of two different systems: research and commercial [4].

However, till the present moment there is no single approach to this notion. It is mostly associated with the complexity and individual nature of the process of formation of the innovative ecosystem. At the same time it should be noted that the foundation for the theory of innovative ecosystems are quite broadly covered theories of innovative systems and innovation environment.

The analysis of the research literature showed that despite the significant volume of research papers investigating the problems of formation and development of innovative ecosystems, many issues in this field are debatable and on the elaboration stage. At the same time practically all scholars are unanimous that the innovative ecosystem acts as a priority model for the innovative development of the economy of the state, region and enterprise.

The papers of domestic and foreign scholars such as Akhmadeyeva B.A., Moiseyev N.A., Romanova V.P., Sidorova D.V., Tsiteladze D.D., Shkarupet E.V., Deborah J. Jackson, Martha G. Russell, and Still K. have a particular value in the area of studying innovative ecosystems and developing the models of innovation ecosystems. Also, the analytical reports and reviews of different companies and organizations (RVC, OECD etc.) considering not only analytical data but also the methodology of the innovation systems under study should be noted.

IV. Research Results

Imbalance of the Innovative Development of RF Regions

Non-uniformity of the innovative development of the Russian regions is observed when considering the ratings associated with their innovative activity. Thus, "The Rating of the Innovative Regions of Russia: 2017" (Table 2) made by the Association of the Innovative Regions of Russia (AIRR) includes a lot of parameters and indicators that allow an objective assessment of the level of the regional innovative development. The rating system of assessment

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includes 29 parameters that are divided into 4 primary groups: scientific research and developments, innovative activity, socioeconomic conditions of the innovative activity, innovative activity of the region [5].

Table 2: Rating of the Innovative Regions of Russia 2017 [5]

Rank	Region	Estimate indicator	% from the average	Group of the region
1	St-Petersburg	0.71	183.8%	Strong innovators
2	Moscow	0.69	179.3%	
3	The Republic of Tatarstan	0.66	173.3%	
4	Tomsk oblast	0.63	163.9%	
5	Novosibirsk oblast	0.57	148.5%	
6	Kaluga oblast	0.55	143.8%	
7	Moscow oblast	0.55	142.8%	
-	-	-	-	-
30	Khabarovsk Territory	0.41	105.8%	Mean-strong innovators
31	Irkutsk oblast	0.40	104.5%	
32	Astrakhan oblast	0.40	104.4%	
33	Belgorod oblast	0.40	104.3%	
34	Altay Territory	0.40	104.2%	
35	Omsk oblast	0.40	103.9%	
36	Ivanovo oblast	0.40	103.7%	
-	-	-	-	-
58	Kostroma oblast	0.33	84.9%	Mean innovators
59	Kamchatka Territory	0.32	83.8%	
60	Pskov oblast	0.32	83.7%	
61	Kemerovo oblast	0.32	83.2%	
62	Orenburg oblast	0.31	81.3%	
-	-	-	-	
81	The Republic of Tyva	0.20	52.4%	weak innovators
82	Nenets Autonomous District	0.20	51.5%	
83	Chechen Republic	0.20	51.3%	
84	The Republic of Ingushetia	0.17	45.3%	
85	Chukotka Autonomous District	0.17	45.1%	

*Composed by the authors basing on the data of the Association of the Innovative Regions of Russia

The rating objectively confirms non-uniform innovative development of regions. The first 7 regions have the highest index, after which there is a sharp drop. It allows making a conclusion that in regions being on outsider positions there was not created a favorable environment for the innovative development, and they function in the status of catching-up entities. In such case they should actively develop the innovative ecosystem that will intensify the innovation process.

Similar situation is observed in the rating of innovative development of the entities of the Russian Federation made by the experts of the Higher School of Economics (HSE) in 2017.

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Figure 1: Structure of the Russian Regional Innovation Index [6]

A system of HSE rating parameters has something in common with the AIRR rating, but there is a difference in distribution of places which is associated with the year of the rating composition.

The calculation of the Russian regional innovation index (RRII) is based on the system of parameters reflected in Figure 1 (altogether 37 parameters) that are grouped into four topical units: socioeconomic conditions of the innovative activity, innovative activity. The final index - RRII is formed as mean arithmetic of normalized values of all the parameters included in the rating [6].

This rating also clearly reflects the situation of non-uniform innovative development of regions (Table 3). The first 10 regions have a rather high index (0.46-0.57), in which respect they can obtain certain advantages. It should be taken into account that regions are on the top positions not due to the natural or other potential independent of the human, but due to the energetic activity for the improvement of the innovative component.

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Table 3: Rating of the Innovative Development of Entities of the Russian Federation 2015

(Russian regional innovation index - RRII) [6]

Region	Group as per RRII	Rank as per RRII	Value of RRII
The Republic of Tatarstan	I	1	0.5753
Moscow	I	2	0.5361
St-Petersburg	I	3	0.5207
Nizhny Novgorod oblast	I	4	0.4981
-	-	-	-
Khabarovsk Territory	II	12	0.4242
Perm Territory	II	13	0.4136
Moscow oblast	II	14	0.4133
Voronezh oblast	II	15	0.4127
Belgorod oblast	II	18	0.4020
-	-	-	-
Rostov oblast	III	26	0.3716
Altay Territory	III	27	0.3658
Yaroslavl oblast	III	28	0.3593
Yamalo-Nenets Autonomous District	III	29	0.3542
-	-	-	-
The Republic of Dagestan	IV	67	0.2563
Chukotka Autonomous District	IV	68	0.2558
The Republic of North Ossetia-Alania	IV	69	0.2505
Kabardino-Balkar Republic	IV	70	0.2504
Jewish Autonomous Region	IV	85	0.1637

*Composed by the authors basing on the data of the Association of the Innovative Regions of Russia

Especially important are the global ratings that combined with the in-country ones allow determining the reserves for the potential growth of the innovative sphere. One of the global ratings is the "Global innovation index 2018" prepared together with the Cornell University, INSEAD business school and the World Intellectual Property Organization (WIPO). This rating takes into account multiple factors. Two primary groups: Innovation resources (institutes, human capital and science, infrastructure, development of home market, business development) and innovation results (development of technologies and knowledge-based economy, development of the creative activity) [7].

The first places of this rating are traditionally taken by such countries as Switzerland, Netherlands, Sweden, Great Britain and USA. China made a rapid progress ranking 37th in this index in 2008, and in 2018 ranking 17th, which is associated with the strategic course for innovative development of economy taken by the government of the country.

At that Russia in 2018 ranked 46th in the global innovation index (in 2017 it ranked 43d, and in 2014 - 49th), being in the same row with Vietnam and Chile. The Russian Federation ranges mostly within 40-50 places. It testifies that RF still has a lot of problems in the area of innovative development. However at the same time there are numerous opportunities for intensive growth [7].

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In the first turn the growth points of the innovative component of the Russian economy can be the regions having sufficiently high innovation potential. However, the low level of efficiency of using this potential is observed which objectively reflects the in-country rating of the innovation development.

Ways of the Innovative Development of RF Regions

In the existing situation of imbalance of the innovative development of RF regions, two primary ways for the innovation policy of the state are formed:

- Focusing main efforts on the developed regions;
- Forming favorable conditions for the innovative development in lagging regions.

The first approach implies focusing all tools on the leader regions in the innovative development such as Moscow, St-Petersburg, the Republic of Tatarstan, Tomsk oblast etc. At that it is expected that outsider regions will raise their level of innovative development on their own by means of internal resources and basic federal support. In this case the imbalance in the innovative activity of regions will only grow.

The second approach is the most acceptable in the given conditions, since it is rational distribution of external resources (federal) combined with an efficient use of internal potential of the region that can result in the maximum synergistic effect.

It is important to select an optimal model of the innovative development of the region. In the Russian Federation classical linear model of the innovative process prevails, which implies a standard chain from the fundamental research to innovation commercialization where the impetus is science. At that low activity is observed on the part of state bodies and business structures. Which means that the primary principles of the "triple helix" model developed in the 90th by well-known scholars H. Etzkowitz and L. Leydesdorff are not observed. The triple helix model implies close cooperation of 3 main entities of the innovative process (Fig. 2) [8].

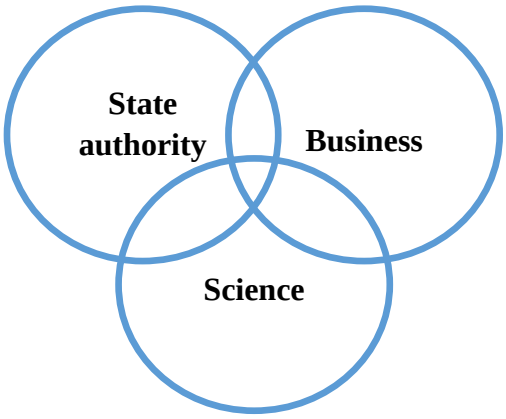

Fig. 2: "Triple Helix" model [8]

All modern models of innovative development of any economic entity should be built basing on this model, which is proved by all well-known efficient practices worldwide.

It seems to us that in conditions of Russian reality the most acceptable is the formation of models of innovative development based on the ecosystem approach which similarly to the biological ecosystem implies the formation of

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optimal conditions for the innovative process involving all structures of the primary entities of innovation theory (state authority, science, business).

Innovative Ecosystem of the Region

As it was already mentioned the ecosystem approach started to be considered relatively recently and was built on the basis of concepts of the innovation systems and innovation environment. The main distinctive feature thereof is the high level of self-organization and cooperation of the entities, which results in the optimization of all innovative processes and intensification of innovative development.

According to the methodology of the Russian Venture Company (RVC), the "innovative ecosystem - is a combination of entities cooperating in the process of commercialization of innovations and their interrelations accumulating human, financial and other resources to intensify, optimize and secure the efficiency of innovations commercialization"[3].

Proceeding from this definition the innovative ecosystem is a highly organized favorable environment for intensification of the innovation process. For countries possessing huge resource potential and large territory especially important is the process of creation thereof on the regional level, since it will enable to use efficiently the individual capacities of each territorial entity.

When considering the ecosystem approach in the innovative activity it is essential to pay attention to the concept of "open innovations" certain elements of which are established in the process of formation of the innovative ecosystem. The concept of open innovations was stated by H. Chesbrough in 2003 and introduced by the executive director of the Center of Open Innovations at the University of California. It is considered as a paradigm of the innovative business presuming more adaptive policy with respect to scientific research and developments and intellectual property [9]. The concept of open innovations presumes banishment from the linear model of the innovation project development.

"Open innovations" imply that the system becomes open for cooperation with the external environment:

- First, specialists and talented developers can be engaged from the external environment (a company, region or another entity cannot possess all possible human resources for the innovation process);
- Second, the project can be more flexible and adaptive, that is the project can leave the parent company on any development stage, whereas the company in its turn can accept external projects anytime.

The innovative ecosystem of the region is quite a close notion to regional innovative systems and territorial clusters. Since when disclosing such notions usually this entails the territorial binding of a certain structure, which means the territory of the region (oblast, republic) is engaged. Many experts unite the notions of the regional innovative ecosystem and territorial cluster in accordance with this parameter, consequently the innovative ecosystem of the region is not an exception. The main difference is the introduction of certain decentralized and self-organized principles that imply that the region should elaborate the most favorable climate in the field of innovation theory that would help to intensify the innovative process by means of an active interaction of all participants. At

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that especially important are the processes of elaborating new models of thinking of innovators and potential innovators, which in digital economy will result in additional incentive for innovative development.

J. Moore introduced a term "entrepreneurial ecosystem" which is practically identical to the notion of "Innovative Ecosystem." Business-ecosystem - is "dynamic and jointly developing communities consisting of different entities creating and obtaining new content in the process of both interaction and competition" [1, p. 213]. Analogy with the biological ecosystems became rather popular in the economic sphere for simulating the systems with large number of stakeholders closely interacting with each other, to which in accordance with the theory of C. Freeman innovative systems and clusters can be referred [9].

According to investigations of C. Mason and R. Brown the entrepreneurial ecosystem of the region - is "a set of interrelated entrepreneurial actors (potential and existing), entrepreneurial organizations (companies, venture capitalists, business-angels, banks), institutes (universities, public institutes and financial bodies) and entrepreneurial processes (number of businesses established, number of fats-growing companies, number of serial entrepreneurs, level of entrepreneurial ambitions) which are combined formally and informally, intermediate and regulate the performance within the frameworks of the local entrepreneurial environment" [10].

The basis of functioning of the innovative ecosystem of the region - is flow of capital and other resources in conditions of close relations between the economic entities, which objective is a technological development and commercialization of innovations. The economic resources in this case include not only material resources (monetary resources, fixed capital etc.), but human resources as well, which are of particular importance during the establishment of the digital economy.

The structure of the innovative ecosystem is represented by the following institutional units: small innovative enterprises (SIP), corporate structures, universities and research institutes, business schools, venture companies and investment funds, state bodies etc.

By its nature the innovative ecosystem acts as a highly organized association of two systems: research and commercial. The main objective of the state is to ensure optimal conditions and stimulate the flow of investments from the commercial sector to the area of scientific research and development. The task of creating the ecosystem of the innovative development of the region - is forming conditions for predominance of self-initiation by the commercial sector of research developments which will be completely different from the current situation when the state is the main initiator of the research activity.

One of the main problems in the formation of the innovative ecosystem of the region is the fact that the process cannot be quick. By the example of the "silicon valley" the creation of the innovative ecosystem can take up to half a century and not finish, since the ecosystem is a constantly developing organism. At that the accelerated development is seldom possible in the process of innovative ecosystems formation, since "it is a complex nonlinear self-consistent process which similarly to biological processes of embryo development cannot be accelerated" [9, p. 53]. The attempts of artificial acceleration can cause destructive consequences. Therefore each innovative ecosystem represents a unique organism to the formation of which one should approach basing on individual peculiarities. At

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the same time each innovative ecosystem has common features on the basis of which the parameters of progress of these systems can be compared.

Thus, one can agree with Karanatova L.G. and Kulev A.Yu. who regards that "regional innovative ecosystem - is the most developed element of the national innovative ecosystem since the territory is simultaneously a consumer and customer of innovative products, services, innovations directed also at creation of comfortable conditions for the achievement of competitiveness of territories in the problems of ensuring the innovative development of meso-level - competence of human capital" [11, p. 41].

Model of the Innovative Ecosystem of the Region

At high level of nonlinearity of innovative ecosystems they can be subjected to the simulation process, that it a unified model can be identified that will reflect all features of the existing efficient systems.

On the basis of the "triple helix" model and schemes of efficiently functioning innovative ecosystems ("Silicon valley," MIT (Boston), Cambridge, Harvard, Tomsk oblast, Tatarstan, Samara, Kaluga etc.) [3], a model of regional innovative ecosystem can be formed (Fig. 3).

The core in this model will be the "coordination center of the innovative development of the region." Other names of this structural unit are possible: Agency for the Innovative Development, Innovations Coordination Center. The primary function of the body will be coordinating the innovation activity in the region and regulating all flows (financial, informational, material).

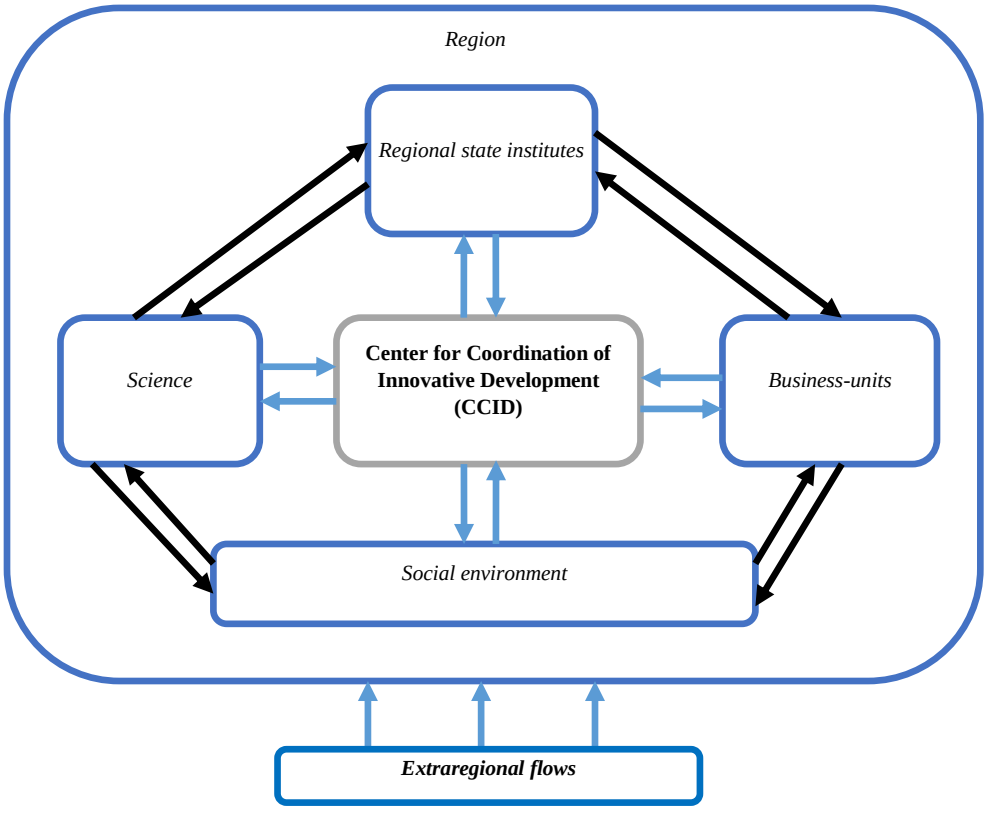

Fig. 3: Model of the Innovative Ecosystem of the Region

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Four primary elements of the innovative development model.

a) Regional state institutes: regional government, interdepartmental groups, departments etc.
b) Science: universities, research institutes, units of ideas generation (art spaces, coworking centers, loft spaces, business-spaces) etc.;
c) Business-units: holdings, enterprises, financial and industrial groups, investment funds, venture funds and companies etc.;
d) Social environment: social institutes, different groups of population, community groups.

All elements of the innovative development model should be in close interrelation which implies a continuous process of exchanging different flows (information, resources). Social environment in this model is an obligatory participant of the innovation process, since the innovation model of regional development will be successful in the case when a society will be formed that functions on the principles of innovative development. Otherwise the changes will be rejected.

At the beginning of establishing the innovative ecosystem, CCID should have the following functions: coordinating innovative development, consulting, monitoring and using information sources, adapting the use of state programs to the conditions of the region, attracting finance, attracting partners and many other. At that extraregional flows in the field of innovation theory are also processed and redirected by the center. Eventually, CCID participation in the innovation processes of the region should decrease to minimum basic functions: providing information and consultations. Thus, a full transition to the efficient self-organization of the system will take place.

The primary advantages for the region upon creation of the innovative ecosystem will be:

- Creating favorable environment for innovations and investments;
- Forming of the territory of constant positive changes;
- Improving the economic situation in the region;
- Raising the living standards of the population of the region.

At that it should be noted that creating the innovative ecosystem of the region is a long-term and labor-intensive process, however, the positive effect will manifoldly pay back all spent resources.

V. Discussion Of The Obtained Results

The results obtained in the course of the research proved the hypothesis of a nonuniform innovative development of RF regions. It testifies that new models of developing the innovation processes of regions should be introduced. One of such models can be the innovative ecosystem of the region the introduction of which will result in the formation of favorable conditions for the innovative development and intensification of activity of the main entities of the innovation process.

The research is limited by the possibility of practical approbation of results, however, on the example of already functioning innovative ecosystems of territorial entities, simulation maximally close to real conditions can be held.

The research results can be applied when generating the innovative strategies for regions development. However, the main objective will be the introduction of a ecosystem approach at all levels (national, regional and corporate).

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In the course of future research devoted to the given subject-matter, it is proposed to adapt the model of the innovative ecosystem of the region to conditions of one of RF regions and thoroughly consider the operation of each element of the innovative ecosystem of the region.

VI. CONCLUSIONS

According to different ratings in the Russian Federation there is a difference between the innovative development of regions, which causes imbalance in the economic sphere and consequently in many other spheres as well. In the global innovation index Russia is on catching-up positions, therefore it is required to analyze the condition of the innovative sphere in Russia and introduce new models for development of this sphere in regions. Since the regions lagging in the innovative development can be the potential growth points for the state economy and qualitative improvement of positions of the country in global ratings, it is required to elaborate and hold the measures aimed at stimulating the innovative activity. In this case of the efficient steps will be the introduction of the concept of regional innovative ecosystems presuming active involvement in the innovative process of all the participants thereof and further intensification of their cooperation. The innovative ecosystem of the region represents a favorable environment for commercialization of innovations and intensification of innovation processes based on the principles of self-organization and self-development. Introducing the model identified in the research into the system of regional development will allow a region to obtain a number of advantages, such as an additional inflow of investments, raise of the innovation activity and formation of a favorable innovative climate.

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