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ROLE OF INTERNATIONAL FACTOR IN INNOVATION ECOSYSTEM FORMATION

Abstract. New stage of the national innovation system concept is developed using evolutional approach to the phenomena and processes analysis, occurred in economy. In this context, formed an idea of innovative ecosystem has been formulated.
The article deals with the analysis of potential of open innovation system based at the international transfer of technology and innovative communications using an ecosystem approach. Generally, high technological business can not exist out of ecosystem which is formed around it by all participants of innovative process. Increasing integrity of different technologies caused multidisciplinary technologies and knowledge growth, and also positively effects of both processes: research and innovation internationalization. International aspect is essential to examine with innovative hubs cooperation, which is the innovative system, formed in the ecosystem. Hub, additionally to the development of its own innovative projects and infrastructure, gives informational and consulting, scientific and technological, infrastructural and producing services to solve technologies transfer tasks. Innovation hubs create an effective field of innovative communications (InCo), the main task of which is to stimulate an open dialogue of the innovative activity stakeholders and their cooperation with the help of specialized approaches.
State role in innovative ecosystems development and the high technologies transfer is defined by the following factors: necessity to stimulate the national economy development as the precondition of stable demand for innovations; possibility to accumulate and orient at innovative development sufficient material resources; necessity of the advanced education development; necessity to form integral innovative policy, founded at the principles of innovative activity planning and prognostication; uniting and coordinating of the innovative, scientific and technical activity in the national scale.
The authors proposed to define the main peculiarity of the innovative ecosystem in its openness (economic analogue is internationalization) and getting in the necessary resources from outside through the international technology transfer.
Keywords: national innovation system; ecosystem; international technology transfer; innovation hub.
JEL Classification: A10, F02, O14, O32, O33

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РОЛЬ МІЖНАРОДНОГО ФАКТОРУ В ФОРМУВАННІ ІННОВАЦІЙНОЇ ЕКОСИСТЕМИ

Анотація. У статті розглянуто основи екосистемного підходу до формування інноваційної системи. Використання зазначеного підходу відповідає новітнім науковим умовам використання міждисциплінарних досліджень. Авторами запропоновано теоретичні основи аналізу відкритості інноваційної екосистеми на основі міжнародного трансферу технологій. Рекомендовано розглядати міжнародну взаємодію на основі інноваційних хабів, що сформовані в певних екосистемах та забезпечують інноваційні комунікації між ними.
Ключові слова: національна інноваційна система, екосистема, міжнародний трансфер технологій, інноваційний хаб.

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РОЛЬ МЕЖДУНАРОДНОГО ФАКТОРА В ФОРМИРОВАНИИ ИННОВАЦИОННОЙ ЭКОСИСТЕМЫ

Аннотация. В статье рассмотрены основы экосистемного подхода к формированию инновационной системы. Использование указанного подхода отвечает новейшим научным условиям использования междисциплинарных исследований. Авторами разработаны теоретические основы анализа открытости инновационной экосистемы на основе международного трансфера технологий. Предложено рассматривать международное взаимодействие на основе инновационных хабов, которые сформированы в определенных экосистемах и обеспечивают инновационные коммуникации между ними.

Ключевые слова: национальная инновационная система, экосистема, международный трансфер технологий, инновационный хаб.

Introduction. The concept of the national innovative system (NIS) gained wide extend in the most EU Member States, the USA, and Japan. However, there is no definition of NIS and its formation methodology till now. Also, NIS of different countries may have different objectives. For example, in France NIS objective is to create additional workplaces, and in Germany – to develop progressive technologies.

In each concrete situation NIS development strategy is defined by the state macroeconomic policy, legal background, forms of direct and indirect state regulation, scientific, technological and industrial potential condition, domestic producing markets, labour markets, historical and cultural traditions, etc.

Brief Literature Review. Theme of current article is connected with the researches of such influential scientists as Semenova N. N. (2008) [1], Khlebnikov D. (2013) [2], Adner R. (2010) [3], Heiko Troya (2012) [4], Titarenko G. B. (2013) [5], Soskin O. I. (2013) [6], Hwang V. W. & Horowitt G. (2012) [7], Popper S. (2002) [8], Wagner C. (2002) [8]. In the research [6] it was noticed that the choice of imperative's vector is an important precondition for future states' economic model forming in the period of the state's economic and technological transition to the sixth technological mode. With the necessity of this choice the new stage of the NIS concept development is connected. Its content is in using evolutional approach to the phenomena and processes analysis occurred in economy. In this context, there was formed an idea of innovative ecosystem, which takes into consideration experts' conclusions concerning necessity to make original national-based innovative ecosystems and to step away from the general tendency to proceed previously realized successful foreign initiatives.

The purpose of this research is to analyze the potential of open innovation system based at the international transfer of technology and innovative communications using an ecosystem approach.

Results. Victor W. Hwang and Greg Horowitt (2012) [7] firstly offered to build a model of innovation ecosystem, including insights on sociobiology from Harvard, economic transactions from the University of Chicago, and design theory from Stanford. They included Culture in the innovation ecosystem model, talking about Social Contract and Trust within the system. Whereas neoclassical economists believe that wealth is based on inputs – such as labor, land, capital, and perhaps technology – the authors argue that such a theory fails to describe the behavior of innovation ecosystems. To explain the difference between highly productive systems like Silicon Valley and most other places in the world, what is most important are not the ingredients of economic production, but the recipe – the way in which the ingredients are combined together. Human systems are the most productive when talent, ideas, and capital are allowed to flow freely [5].

To form innovative infrastructure as ecosystem around the modern production, it is essential to create conditions for scientific and engineering companies appearing. The most prospective innovative decisions come only in such small scientific and research groups. However, then the original idea has to be embodied in the research sample, and after that in the small-lot set. The presence of production for ideas correcting and realizing is an important factor to develop innovations. Time interval, which is necessary for idea transfer into final product, should be minimal.

High technological business can not exist out of ecosystem which is formed around it by all participants of the innovative process.

Ecosystem of innovations includes 5 main elements:

1) science, engineering and technical society and higher educational institutions (HEIs) are the main suppliers of the innovative ideas for commercialization; personnel, which forms vendors teams for technological companies and scientific-technical expert evaluation;

2) sphere of the venture capital investments, responsible for financial resources and business competences involvement into the ecosystem, necessary for innovative companies establishing and turning them into complete business;

3) infrastructure which creates favourable conditions for innovative companies existence. Infrastructure may be both material (techno-parks, incubators, technical and innovation centres) and non-material («soft»). The last is understood as various services, specially made for needs and specifics of innovative companies, for example, intellectual property protection services, services on innovative production withdraw and promotion to foreign markets, outsourcing of «non-innovative» activity aspects;

4) sustainable demand for innovations as a formula of the whole ecosystem success. The issue is not only consumer market, but also demand of the great business and other real sectors of the high technological production for technologies and innovative companies together with all their inventions and intellectual properties (as perspective objects of purchasing);

5) legislative and legal framework that forms comfortable conditions of work not only for the most innovative companies, but for all ecosystem participants, and provides convenient rules of game, which give opportunities to build interest balance between various market players.

Today it is often mentioned the fact that innovations infrastructure has already been practically formed, because there are researchers and scientists, innovative managers, investors, techno-parks and incubators.

However, effectiveness criterion in the innovative sphere is not the fact of existence, but the level of qualitative effectiveness, cooperation and systematic. Such approach needs to investigate objective criteria of the «breakthrough» product, because with absence of such criteria it is probably to use non-productive resources (means, state budget etc) in such case. The analysis of innovative system as ecosystem shows that to

understand innovative system as ecosystem, it is necessary to notice that:

- information in the ecosystem is transmitted cyclically, forming integral outline by such way. Every informational message, sent from addressee to receiver, effects in some way both an addressee and receiver. The feedback relations are fixed in the cycle of informational exchange between the addressee and receiver;
- informational exchange either supports or transforms the cycle. There is support and development in the balanced ecosystems during informational exchange. The degradation occurs in the unbalanced cycle with feedback deviation;
- any ecosystem has some level of closeness or openness, but it can't have fully open and close character at once. Trying to create a picture, at which all «knowledge», necessary «to master», within ecosystem, we devalue knowledge;
- in the ecosystems knowledge can't be formed in only one way. It gets various forms in the process of information exchange;
- in the ecosystem «knowledge» is not formulation, but components of the actual experience zone, on the base of which there may be solved important problems. And the development is known to occur during new components mastering, which are in the nearest development zone.

Tab. 1: **Factors of the innovation ecosystem success**

Factor	Essence of the factor	Meaning of the international transfer
Strategy and promotion of the system	- exactly fixed ecosystem objectives - global strategy and ecosystem positioning, brand creation - concrete task orientation - evident support in the project realization by the company's authority	international innovative-investment image
Management	- effective project control of the ecosystem - motivation and regulation of the ecosystem participants' activity - timely estimation and correction to provide objectives	global strategy
Infrastructure	- effective infrastructure for communication, cooperation, preservation and exchange of information - activation of the technical opportunities and instruments of the ecosystem with demand advance	global strategy
Strategic partners	- HEI and scientific-research organizations - companies which actively investigate new production and innovations (ventures)	international cooperation
Participants involving	- benefit defining for all ecosystem participants and their communication with new participants - events concerning participants involving within ecosystem promotion program	international innovative-technological cooperation
Innovative process	- stimulating of the cooperation between ecosystem participants - providing of the innovative ideas transfer between innovative process stages - realizing of the innovations selection, estimation and commercialization into the ecosystem processes	global innovative system resources usage

Source: The Authors' own development

The ecosystem formation has 3 stages. The background conditions are formed at the first stage when there is very high concentration of talent and education, which provides growth of the innovative teams trying to create something. The second stage (pre-emergence) is the most complicated and foresees the first crucial mass of the innovative firms' appearing, which makes the ground of the innovative infrastructure development. The innovative ecosystem with crucial mass of the venture capital and specialized firms appears at the third stage.

We found that by the analogy of the nature ecosystem with high biological activity, which includes representatives of many species, among which there are various relations (contest, cooperation, coexistence), innovative cooperation is also a very complicated system, consisted of managers, engineers, sellers, advisors, consultants, venture capitalists, business-agents, marketers, bank-workers, who support friends, and so on.

One of the main ecosystem's feature is its openness, i.e. the ability to perceive new type for it (it is connected with unoccupied ecological niches). The open ecosystems have processes of entropy decrease; it means that such systems have minimal entropy. With the analogy to biological approach authors propose to define the main peculiarity of the innovative ecosystem in its openness (economic analogue is internationalization) and getting in the necessary resources from outside. The resource channel is the international transfer of the technologies in an extended sense – transfer of the evident and not evident knowledge with the aim to obviate system's fragmentation. Table 1 shows the main factors of the innovative ecosystems development, and also the international factor effect on their functioning.

As in the nature ecosystem, there are balanced connections, formed between its different levels and elements, so in the innovative ecosystem the negative effects (companies bankruptcy, conditions complication) don't cause the whole cooperation destruction, because it depends not from some companies' success, but from the support of the right environmental balance, allowing to recombine different factors that increase probability of the new successful connections appearing.

The basic causes of the innovative systems internationalization include necessity to form additional competitive advantages with the aim to avoid the «closing effect», which appears as extra closeness and orientation at the local market and ideas. It is necessary to find the niche in the global economic space.

Thus, we can conclude that evolutional processes in the ecosystems are easy to describe through examination of relations, which are changing, between ecological niches and ecological licenses.

A license may be defined as the ecosystem's ability to give the existed in it population or new population the following:

1) precise position in space and time,
2) precise position in the gradient of environmental factors,
3) precise role in the streams of matters, energy and information.

As for the technologies, the license concept corresponds to the nowadays peculiarities, especially rejections from traditional technological tying.

Top-technologies include many other technologies. So, nanotechnologies, based at micro-world discoveries, are used in the informational technologies, while new materials creating – in biotechnologies and medicine. In general, there are 40 ways of their usage [1]. The increasing integrity of different technologies caused the multidisciplinary technologies and knowledge growth that has positive effect on both processes: research and innovation internationalization. Complexity makes innovations more expensive and risky, stimulating companies to find partners with necessary experience to get fast access to different knowledge and technologies.

As for Ukraine, for example, in native microelectronics there are a few big enterprises with competitive producing, a few dozens of small and hundreds of medium engineering companies which don't have their own production facilities. They are parts of the previous powerful soviet scientific and production complexes, consisted of strategic resources and serial plants. At that time the vertical integration allowed the USSR to take the third place after the USA and Japan in the world in electronic components production. So far, more than 90% of microelectronics in Ukraine is imported from abroad. To return lost

positions is possible through consolidation of the industrial branches with the help of technologies transfer in the ecosystems and technological break reduction.

The state of the high technological enterprises ecosystem may be described by factor correlation of the environment quality (Table 2).

Tab. 2: **Ecosystem's impact on the innovative firms' problems**

		External challenges	
		Low	High
External innovative problems	Low	Internal problems of the innovative development	Internal problems + external limits on consumption
	High	Internal problems + external limits on production	Internal problems + external limits on production and consumption

Source: [3]

We investigated a new method of analyzing of international aspect based on innovative hubs cooperation, which are innovative systems and are formed in some ecosystem (Figure 1). Hub additionally to the development of its own innovative projects and infrastructure, gives informational and consulting, scientific and technological, infrastructural and producing services for technologies transfer tasks solving.

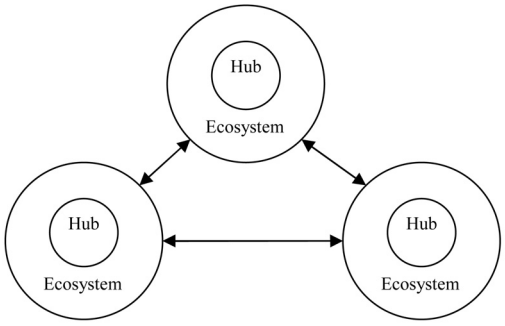

Fig. 1: **Scheme of the innovative ecosystems global nets**
Source: The Authors' own development

We accept that innovative hub functions simultaneously as:
- consulting company which provides the customer with the necessary service on other organizations and resources involving to solve innovative activity tasks;
- scientific and educational establishment;
- owner/founder of one or few objects of the innovative infrastructure;
- producing company which is able to solve many commercialization tasks – from giving the necessary intellectual and financial resources, to the investigation of the prototype, product sample or service.

The authors also emphasize that innovative communications (InCo) in hub are provided in such way that the main task is to stimulate the open dialogue of the innovative activity stakeholders and their cooperation with the help of specialized approaches. It is a special field of communications, which in the long-term perspective, effects on the economy and society, particularly forming and developing the innovative society.

The study provides strong evidence that hub is oriented on communications between science, business and education, connected into «knowledge triangle»:
- InCoUniv (Innovation Communication for Universities) – practice, aimed to make HEIs the centers of the innovative communications and to grow the understanding of the innovations and communications importance at university level;
- InCoSci (Innovation Communication for Scientific Society) – practice, aimed to promote communications between the scientific and research centres;
- InCoCorp (Corporate Innovation Communication) – encouraging and realization the communications strategy in the innovations sphere;
- InCoEd (Innovation Communication in Education) – practice, aimed to grow the importance of the creative potential and innovations in the system of education.

State role in innovative ecosystems development and the high technologies transfer is defined by the following factors: necessity to stimulate the national economy development as the precondition of stable demand for innovations; possibility to accumulate and orient at innovative development sufficient material resources; necessity of the advanced education development; necessity to form integral innovative policy, founded at the principles of innovative activity planning and prognostication; uniting and coordinating of the innovative, scientific and technical activity in the national scale.

Conclusion. During the innovation ecosystem forming, it is important not only to investigate the necessary innovative-investment legislation which connects stability and timely correcting due to the social and technological sessions, but to create real active mechanisms to keep its performance. We suppose that legal system provides conditions of streams flow (informational and resource) in the ecosystem, and regulates its functioning mechanisms.

As a result of this study, the basic causes of the innovative systems internationalization are identified. This issue shows the necessity to form additional competitive advantages with aim to avoid the «locked-in effect», which appears as an extra closeness and orientation on the local market and ideas, so there is a need to find country's niche in the global economic space.

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