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Olga Gashutina, Nina Didenko, N. Novogradska–Morska. Modelling approach in development of the scientific and technological sphere within the national innovation system

The concept of the national innovation systems' development is examined; different scientific approaches to the development of scientific and technological sphere within the national innovation system are analyzed; main directions in the development of scientific and technological sphere in Ukraine are investigated; modelling approach to the development of scientific and technological sphere within the national innovation system is offered.

Keywords: *modeling approach; sphere of science and technology; national innovation system; the model of the national innovation system; patent regime; fiscal measures; human capital; synergy.*

Nowadays the use of the national innovation systems modelling approach to information flow among people, enterprises and institutions is a key to the improvement of the governance mechanisms of scientific and technological sphere. Innovation and technology development is the result of a complex set of relationships among main components in the system, which includes enterprises, universities and government research institutes. Improvement by this modelling approach to the national innovation system can help identify leverage points for enhancing innovative performance and overall competitiveness in our country.

Analysis of recent research and publications

The governance problem of the scientific and technological sphere within the national innovation system was investigated in the works by different researchers and scientists such as R. Ayres, N. Compridis, R. Devol and P. Wong, A. Grubler, M. Middleton, S. Negro, Stine, R. Suurs and so on. R. Ayres [1], N. Compridis [2] and A. Grubler [4] in their works explore the concept of national innovation system in different countries. R. Devol and P. Wong [3] study the institutional approach to the

development of scientific and technological sphere within the national innovation system. M. Middleton [5] and S. Negro [6] analyze different directions in the development of scientific and technological sphere. Stine [7] and R. Suurs [8] investigate modern approaches to the development of national innovation system. However, the problem is not solved completely, which causes urgency topics in further studies.

The purpose of the article

A main goal of the article is to offer directions of the scientific and technological sphere' development.

The main material

The concept of national innovation systems' development states that understanding of the linkages among the actors involved in innovation is a key to improving of scientific and technological sphere.

The national system of innovation has been defined as follows:

the network of institutions in the public and private sectors that interact [2];

the elements and relationships that interact in the production, diffusion and use of new useful knowledge [3];

the set of institutions whose interactions determine the innovative performance of national firms [4];

the national institutions, their incentive structures and their competencies, that determine the rate and direction of technological learning in a country [5];

the set of institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process [6];

the system of interconnected institutions to create, store and transfer the knowledge, skills and artifacts that define new technologies [7].

The concept of the national innovation systems' development should be carried out as follows [6–8]:

1) interaction among enterprises;

- 2) interaction among enterprises, universities and public research laboratories;
- 3) diffusion of knowledge and technology among firms;
- 4) mobility of personnel.

Nowadays national innovation system also suffers from a lack of comparable approaches. The cluster approach is increasingly popular among innovation system theorists, who see value in identifying and evaluating the interactions among a smaller system or group of innovative firms. Systems of interaction and innovation exist to some extent at all these levels.

Predictive modelling transfer of innovation in the national innovation system is a complex problem, and without the use of modern mathematical methods, software-oriented expert-analytical systems do not, given the tight timing and competition [3].

Different scientists and researches tested all known scientific approaches – linear, functional, matrix, divisional, multiple – connecting with the traditional technology management: business planning, project management, personnel management, quality management, etc. These attempts didn't lead to the success. Exploring the final materials for the implementation of the innovation project, the researchers came to the conclusion that a variety of known and proven management systems inadequate diversity of existing innovation system, i.e. the law of necessary variety R. Ayres [1].

The difficulty of keeping heterogeneous factors in modelling of the innovation transfer, according to R. Devol and P. Wong, makes a choice institutional approach to the implementation of the modeling process [3].

To date, various research directions in the field of national innovation systems are developed in different countries. To summarize all researched information we suggest the following level model of the innovation system which can be applied for Ukrainian economy (fig. 1):

Level model of the innovation system development

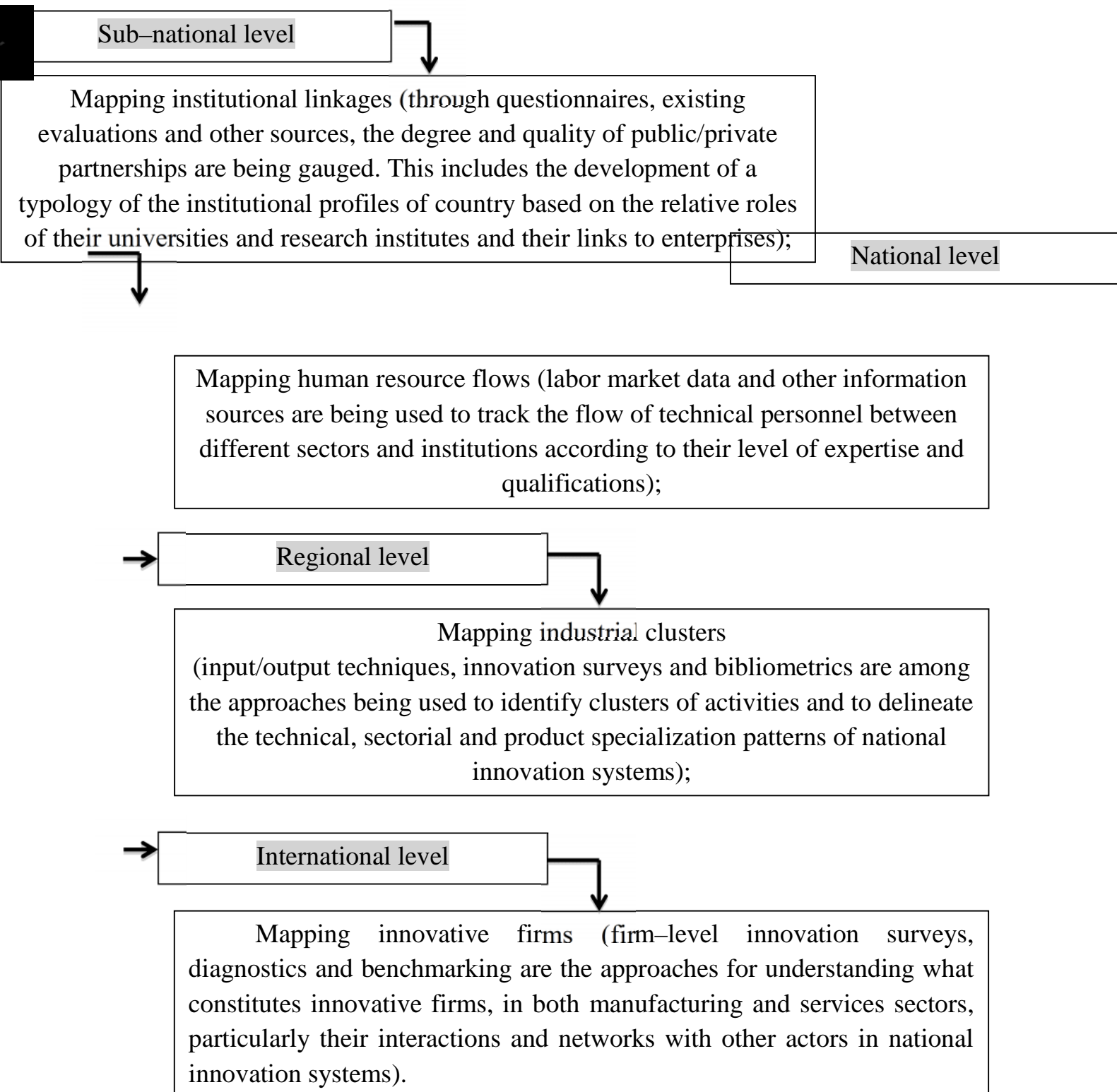


Fig. 1. Level model of the innovation system development' in Ukraine

Thus, according to the above, we offer the following directions of the scientific and technological sphere' development which can be used on the sub-national and national level of the innovation system in Ukraine:

patent regimes play an increasingly complex role in encouraging innovation, diffusing scientific and technical knowledge, and enhancing market entry and firm creation. As such, they should be subject to closer scrutiny by science, technology and innovation policy makers;

human resource development: the number of scientists and technologists, while being large in absolute numbers, is not commensurate with the requirements in quality and when measured on a per capita basis. The demand is bound to increase in the coming years with more intensive activities involving science and technology;

fiscal measures: innovative fiscal measures are critical to ensure successful implementation of the policy objectives. New methods are required for incentivizing R&D activities, particularly in industry. New strategies have to be formulated for attracting higher levels of public and private investments in scientific and technological development.

The achievement of synergy between industry and scientific research and also generation and management of intellectual property is the main directions of the scientific and technological sphere' development which can be applied on the regional level of the innovation system.

The following directions of the scientific and technological sphere' development can be used on the international level of the innovation system in Ukraine:

a closer interaction of those involved in the natural sciences and technology, social sciences, humanities and other scholarly pursuits will be facilitated to bring about mutual reinforcement, added value and impact;

harmonization action plan to strengthen the intellectual capital;

international cooperation in science and technology is vital to meet a broad range of global challenges related to economic growth, better health, sustainable development, and enhanced safety, as well as for implementing large science projects in a growing range of disciplines.

Co-ordinated efforts at national and international levels are needed to broaden access to data research and contribute to the advancement of scientific research and innovation.

Conclusions. Therefore, future research will focus on improving the government of the scientific and technological sphere used to map interactions in the national innovation systems as well as the linkages to the innovative performance of firms and countries. This approach is at an early stage of development and includes recommendations for using cluster method, economic justification of venture funding as the component of scientific and technological sphere' governance and creating the model and the main directions of the national innovation system's development. Thus, considering and analysis all these above mentioned approaches leads to improvement of the governance mechanisms of scientific and technological spheres within the national innovation system.

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