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The economic and legal mechanism of commercialization of R&D results

Abstract

The article presents the study of the processes of commercialization of R&D results. It is emphasized on the urgency of activating such processes in the context of the formation of a new type of economy - the information economy. The information economy transforms both the approaches to the organization of entrepreneurial activity and the factors of competitiveness of economic entities. The prospect of changing the relationship between of higher education sectors, business enterprise sector, the government sector and the civil society sector as the elements of the Quadruple Helix model are substantiated. The authors analyze the current legislation of Ukraine regarding the commercialization of R&D results. It allowed identifying endogenous problems in technologies transfer and their further implementation into the real sector of the national economy. The classification of higher education institutions' R&D results as objects of commercialization is singled out on the base of methods of strategic and structural-functional analysis. The conceptual approach to the formation of the economic and legal mechanism of commercialization of the researches results of higher education institutions in Ukraine are proposed; the authors identifies the typical stages of the mechanism implementation.

Keywords

commercialization, R&D results, higher education institution, economic and legal mechanism, Quadruple Helix model, information economy

1 Urgency of the research and target setting

The current global trend of development of the world's leading countries is the formation of a new type of economic system - the information economy. The characteristic features of information economy are: the transformation of knowledge and information into productive power; the growth of the role of intellectual and information resources in the economy development; the expansion of the knowledge-intensive sector of economy; the increase in the share of workers employed in the science-intensive sector of economy; active implementation of information and communication technologies; raising the level of innovation activity of business entities; the development of innovative consciousness; the increase in the share of high-tech products

in the gross domestic product of the country; the expansion of the information services; the modernization of approaches to the organization of entrepreneurial activity; the formation of a global information space, etc.

The development of entrepreneurship in such conditions faces a number of challenges, first of all, changing the factors of competitiveness of economic entities. The high competitive positions require innovation activity, flexibility and adaptability of enterprises to the changes of dynamical economic environment.

The economic entities' innovation activity is largely based on the efficiency and intensity of research activities of higher education and research institutions of the country. The gaps between the elements of the Quadruple Helix model (higher education sector – business enterprise sector –

government sector – private non-profit sector) reduces the processes of R&D results commercialization in the real sector of the national economy. The Quadruple Helix model is the development of Henry Etzkowitz's Triple Helix model (universities – firms – public organizations). We absolutely agree with scientists who propose to widen Triple Helix adding the civil society (or private non-profit sector – Eurostat, Eurocommision) as one of its important elements (for example R.Arnkil, A. Jarvensivu, P.Koski, T. Piirainen from Institute for Social Research at University of Tampere, Final Report on Quadruple Helix Research for the CLIQ project, 2010).

The higher education institutions' (further - HEIs) scientific and technical potential does not find proper implementation in the industry of the country. In our opinion one of the key reasons of the problem is underdeveloped economic and legal mechanism of commercialization of the R&D results in Ukraine. Our purpose is to study the economic and legal aspects of the mechanism functioning within the Quadruple Helix model.

2 Actual scientific researches and issues analysis

Ukrainian higher education system faces a number of challenges cause by lack of financing. Modern conditions of information economy formation urge the necessity of diversification of universities' funding sources. The most promising directions are activation of fundraising activity and commercialization processes. The aspects of diversification of both funding sources for the higher education, including the scientific and applied principles of commercialization of R&D results, are disclosed in papers of a number of Ukrainian and foreign scientists-economists: Bogolib T., Bruking E., Buchkovska Ya., Varnaliy Z., Volikov V., Galbraith J., Devol R., Illiashenko T., Kaleniuk I., Komarova I., Kuklin O., Lee J., Ratnatunga M., Safonova V., Tsybmal L., Shevchenko L., Shpak N., etc.

The urgency of the issues of commercialization of R&D results causes an increase in the interest of scientists to their study. This leads to the pluralism of scientific approaches to understanding the essence of this category. Ukrainian economist, professor I. Mazur determines the commercialization of R&D results as business associated with the transformation of intellectual activity into income using various forms of trade [3]. In our opinion it is appropriate to note that commercialization is aimed at achieving economic effects (particularly – higher education institutions' income), but nowadays there is a growing role of social effects derived from the commercialization processes. V. Pavlenko notes that "not for all

innovative companies, technology transfer and the commercialization of the R&D results are the main directions of activity; some innovation centers focus only on socially important projects, while others, on the contrary, focus exclusively on the commercial side "[4].

Ukrainian economists A.Samilo, O.Povstin and M. Kupchak propose to consider the commercialization of the R&D results as a return of the expenditures on R&D activities, receiving additional revenues to the special fund of the budget in order to accelerate the introduction of positive results of science in practice, the formation of favorable economic conditions for the development [5]. The debatable is O. Prokhorov's point of view. He considers the commercialization of the R&D results as "... the process of allocation of funds for the creation of intellectual property objects and a phased control over their spending, including the evaluation and transfer of the results of intellectual activity completed and mastered in industrial conditions" [6]. In our opinion, it is inappropriate to restrict the notion of commercialization to the financial aspects of the research and commercialization processes. Doctors of Economic Scientists, Professors M.V. Fedorov and E.V. Peshin insist on the development of various aspects of cooperation within the model "higher education - business - government - civil society" identifying the important task of integrated management of the processes (production, transfer and use of R&D results, development of knowledge-based technologies) [14].

Dr.oec, Professor, V. Bazilevich the commercialization of R&D results understands as the process of their involvement in economic circulation through the sale of exclusive property rights of intellectual property on a contractual basis [7]. This approach to the interpretation of the essence of the analysed term seems to us the most sensible in economic context of our research; we share it and lay in the foundation of our study.

3 Uninvestigated parts of general matters defining

The systematization of recent researches and publications made it possible to define the term commercialization of R&D results as a complex economic and legal category that means the processes of organization and implementation of the transfer of intellectual property objects, the R&D results into the real sector of the economy on a contractual basis. Despite the number of publications on the analyzed issues, the study of the economic and legal mechanism of commercialization of R&D results needs in-depth study.

4 The research objective

The purpose of the article is to study the economic and legal mechanism of commercialization of the R&D results in Ukraine.

5 The statement of basic materials

The economic essence of the R&D results is that commercially-attractive knowledge can acquire a commodity form, because intellectual property can bring profits to their owners. Under the condition of information economy the knowledge, information, innovations, inventions and other research result become a key factor in the evolution of production processes, a key to the success and stability of the country's economic development. So according to such aspects, European countries are creating transnational powerful economy based on modern technologies. Therefore, taking into account the orientation of the Ukrainian economy to deepening constructive socio-economic and scientific-technological cooperation with the European Union, the issue of formation and development of the national knowledge and information services market becomes of special urgency.

Significant scientific and technical potential of the country is concentrated in the higher education sector. The inventions of HEIs scientists often do not find their practical application in the real sector of the national economy. The main reason for this is the gap between the subjects of the higher education sector, business enterprise sector and the government sector as key elements of the Quadruple Helix. The problem of the actual separation of academic and university science from business requests is burdened by the underdevelopment of the economic and legal mechanism of commercialization of R&D results.

The current Ukrainian legislation regulates the aspects of scientific, technical and innovation activity in the country. But also are required the details for the economic and legal basis of commercialization of the R&D results as a promising direction for the intensification of innovation development of the national economy. The term "commercialization" is mentioned in Art. 1 of the Law of Ukraine "On innovation activity" # 40-IV in the context of the following definition: "The innovative activity is the activity directed to the use and commercialization of R&D results and leads to the release on the market of new competitive products and services" [1]. The Guidelines On Commercialization Of Elaborations Created As A Result Of Scientific And Technical Activities (approved by the State Committee of Ukraine for Science, Innovation and Information; # 18; 13.09.2010) defines the commercialization of intellectual property as "the organization of the

movement of intellectual capital in order to profit; and the process of commercialization - as a complex of organizational and economic measures aimed at getting profit from the market realization of available knowledge in the certain branch of science and technology" [2]. The mentioned above legislative documents create the possibility for HEIs' in fundraising activity and diversification of funding sources. That is especially important in the context of current tendency to decreasing of funding from state budget.

First of all, it is necessary to emphasize the legislative aspects of defining the legal status of HEIs in Ukraine, in particular, the issues of the legal regime of property, the right to dispose of the funds received from economic activity, the right to be the founder of the companies. The current normative legal acts identify the HEIs as a legal entity with a special legal capacity. At the current stage of the reform of the higher education system of Ukraine, is being implemented a complex of activities to expand the financial autonomy of universities and institutes. In fact, their business activities are limited to a List of paid services that HEIs can provide [8]. It is necessary to note that this List provides a wide range of services, including educational, scientific and technical, international activities, including the spheres of health care, leisure, recreation, tourism, physical culture, sports, household, housing and other services [8]. Ukrainian HEIs have a significant scientific potential, therefore it is prospective to modernize the marketing strategies of universities and to orient them on promotion of innovative research result on the national and global markets.

The Law of Ukraine On Higher Education (# 1556-18; 2018) established the right of the HEIs to act as the founder / co-founder of other legal entities that carry out their activities in accordance with the directions of educational, scientific, and innovation activities of the HEIs (Article 27). But the current legislation remains unresolved the issues of the procedure for the creation of these legal entities, their organizational and legal forms, etc. [9]. The mentioned above reduce the HEIs' possibilities in commercialization of their R&D results. In other words it causes the limitation in diversification of HEIs' funding sources.

The formation of legal entities by HEIs is provided in Article 13 of the Law of Ukraine On Scientific Parks (# 1563-17; 05.12.2012). In particular, in accordance with paragraph 1 of this article, universities, institutes, academies may be the founders of legal entities or their associations for the organization and implementation of the projects of the scientific park [10]. Articles 29 and 30 of the Law of Ukraine On Higher Education establish the right to create innovative structures of different types: scientific and technological

parks, business incubators, small enterprises, etc. The universities with national or research status could to establish the mentioned above innovative structures; the establishment of these structures should be based on the combination of the interests of high-tech companies, higher education sectors, business enterprise sector, government sector, and the civil society ("Quadruple Helix") in order to carry out and implement innovative projects [9]. Summing up, we can state the legally declared right of HEIs to implement entrepreneurial activity in diversified areas. In other words the current legislation of Ukraine declares the right of universities to establish the income-generating structures of R&D results commercialization.

During the last few years, significant steps have been taken in Ukraine to create favourable conditions for the commercialization of R&D results. There are 16 scientific parks in Ukraine. The following parks are most successfully functioning: "Semiconductor Technologies and Materials, Optoelectronics and Sensory Technology", "Institute of Electric Welding named after E.O.Paton", "Institute of Single Crystals", "Kyiv Polytechnic", "Institute of Technical Thermophysics", "Ukrinfotekh", "Intellectual Information Technologies" [12]. But in practice universities often encounter a number of exogenous and endogenous economic and financial issues at the commercialization processes and functioning of scientific parks.

The imperfection of the economic and legal bases of commercialization of the R&D results of the HEIs in Ukraine is also manifested in the improper development of tax incentives in this area. The current tax legislation provides for minor exemptions in taxing entities in the field of scientific activity. In accordance to clause 140.1 of Art. 140 of The Tax Code of Ukraine determining the object of taxation are taking into account the costs (other than those subject to depreciation) that are related: to the scientific and technical provision of economic activity; to the invention and rationalization of economic processes; to carrying out of pilot experimental and design works; manufacturing of models and samples related to the main activities of the taxpayer; the payment of royalties; and the purchase of intangible assets (other than those subject to depreciation) for their use in the government sector activity of the taxpayer [11]. The analysis of the effectiveness of the implementation of the projects of scientific parks in Ukraine showed low effectiveness and low development level of tax incentives for: 1) project investors and 2) the use of intangible assets of scientific parks in industry. For example, some tax privileges and preferential crediting could become a motivational factor for business enterprise sector to activate the innovation, scientific and technical

activities and cooperation with HEIs. In medium-term perspective it will increase the level of both innovation activity of national economy and global competitiveness of Ukraine.

The following issues should be considered in the economic and legal problems of commercialization of R&D results of Ukraine's HEIs: difficulties with the accounting of patents and other security documents created for the budget funds; the lack of an effective legal mechanism for funding university innovative projects; the need for professional training of specialists in innovative management, protection of intellectual property rights, technology transfer, marketing and commercialization of the R&D results in industry, etc. Particular attention is to be paid to the problem of the existence of gaps between the subjects of higher education sector, business enterprise sector, government sector and civil society (based on the Quadruple Helix model). The mentioned gap could be minimized by implementing the economic and legal mechanism of commercialization of HEIs' R&D results (Fig. 1).

In our opinion, the main functional elements of the economic and legal mechanism of commercialization of the R&D results are the following: 1) resource management; 2) legal protection of the R&D results as objects of intellectual property; 3) promotion of the R&D results to the market; 4) information support; 5) strategic planning of the development of the HEIs. The efficiency of the implementation of the economic and legal mechanism of commercialization of HEIs' R&D results needs identification and maximum inclusion in the commercial turnover of potential commercialization objects (Table 1). At the current stage the legal aspects of functioning of the mechanism of commercialization of R&D results of HEIs in Ukraine are developed, but economic aspects, financial and tax incentives should be formed and tested in practice.

In our opinion, the implementation of the proposed mechanism includes five logically stages:

Stage I - the consideration of influence of institutional, scientific and technical, financial and economic factors on commercialization processes; identifying market needs and aligning them with the HEI profile; objective assessment of available scientific and technical resources and their commercial attractiveness; identification of potential sources of funding of research activities;

Stage II - carrying out of marketing research; the preliminary choice of ways of commercialization of the planned researches results; preliminary assessment of the commercial potential of planned researches results; identification of available funding sources; search for potential customers; fundraising activity; organization and realization of research

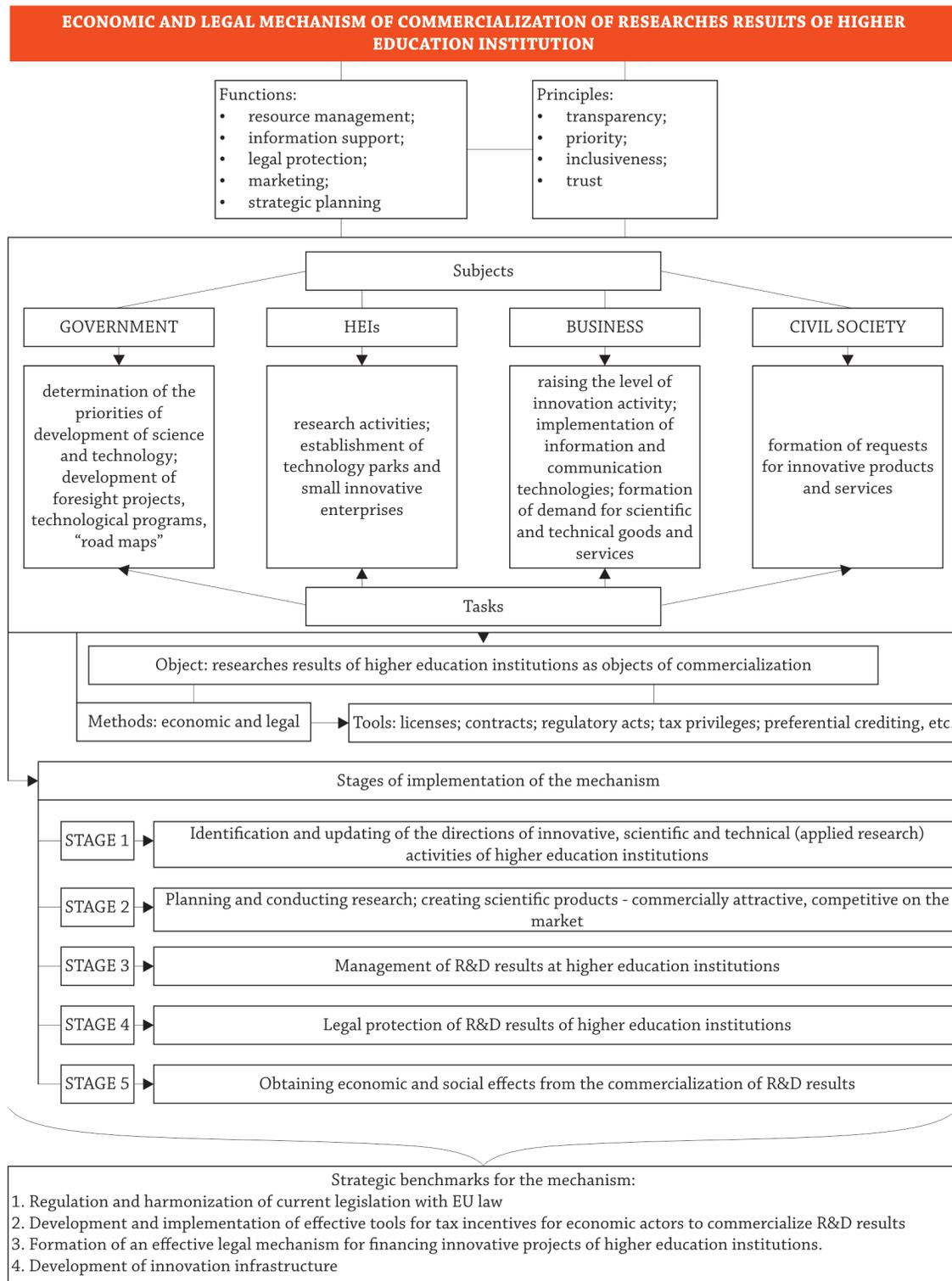


Figure 1 The Scheme of the Economic and Legal Mechanism of Commercialization of the Researches Results of HEIs on the Quadruple Helix Model. Source: compiled by authors.

TABLE 1 Classification of HEIs' R&D results as objects of commercialization

Classification group		Types
1	Affiliation to the type of activity	1) fundamental research; 2) applied research; 3) research and development (R&D); 4) educational and methodological developments
2	The term for obtaining scientific R&D results	1) long-term (more than 3 years); 2) medium-term (1-3 years); 3) short-term (up to 1 year); 4) used in current activities
3	Sources of funding	1) external financing (grants from international organizations and foundations); 2) state financing (government procurement, targeted programs, state funds); 3) private financing (venture investment, joint activity, sale of rights, sale of services); 4) mixed financing; 5) creation of endowment funds (the investment funds which are funded by donations (including the HEI graduates as donors))
4	Depending on the customer	1) scientist's initiative; 2) higher education institution's internal need; 3) state order; 4) contract with business sector
5	Depending on the way of commercialization	1) transfer of R&D results (sale of rights, formation of small innovative enterprise, transfer of R&D results to the customer under the contract); 2) internal use (in educational process, in further research activities, in provision of services, etc.)

Source: compiled by authors on the basis of [12-13]

process; substantiation of research priorities;

Stage III - accounting and inventory of R&D results; technical, economic and commercial audit; financial management; classification of R&D results due to the criteria of innovativeness, competitiveness, commercial potential and methods of commercialization;

Stage IV - ensuring the legal protection of HEIs R&D results; patenting inventions at national and foreign patent offices; support for patents validity;

Stage V - choice of forms, ways of transfer the rights on R&D results; commercialization process; receiving income, economic and social effects from the R&D results transfer.

6 Conclusions

One of the main tendencies of Ukrainian higher education system development is decreasing of funding from state budget. Under such conditions HEIs are activating the fundraising activity and diversify funding sources. The conducted research allows coming to the conclusion about the relevance of the development of commercialization of HEIs' R&D results as a promising direction of funding sources diversification.

The implementation of innovations and R&D results into the real sector of national economy is capable of ensuring the country's innovative development and raising its competitiveness at the global level. The implementation of commercialization processes in Ukraine faces a number of endogenous issues due to: the imperfection of the current

legislation; the declarative nature and inconsistency of some normative provisions; underdeveloped financing models of innovative projects; the imperfection of tax incentives of economic actors to the research and innovation activities; the lack of an effective economic and legal mechanism of commercialization of HEIs' R&D results. At the current stage the legal aspects of functioning of the mechanism of commercialization of R&D results of HEIs in Ukraine are developed, but economic aspects, financial and tax incentives should be formed and tested in practice.

The authors identify the key stages of realization of the economic and legal mechanism of commercialization of the R&D results of HEIs in Ukraine. In the article are defined the prospects of realization of the economic and legal mechanism of commercialization of the R&D results: the establishment of the HEIs' rights on commercialization of the objects of intellectual property (in particular R&D results); formation of structures focused on the implementation of R&D results; to become the founder / co-founder of small innovative enterprises for the purpose of commercialization of R&D results, and transfer of objects of intellectual property rights; formation of a preferential regime for the activity of innovative enterprises created on the basis of the HEIs (or to provide subsidies for such enterprises).

The prospects for the further research are to study the best practices of world universities in the commercialization of the R&D results with a purpose of its further adaptation to the Ukrainian social and economic circumstances.

References

- [1] *Law of Ukraine On Innovation Activity* 04.07.2002. #40-IV **E-resource:** <http://zakon5.rada.gov.ua/laws/show/40-15> (in Ukrainian)
- [2] *Methodological recommendations on the commercialization of elaborations, created as a result of scientific and technical activity* State Committee of Ukraine on Science, Innovation and Informatization of September 13, 2010 **18 E-resource:** http://search.ligazakon.ua/l_doc2.nsf/link1/FIN58763.html (in Ukrainian)
- [3] Mazur I 2013 *Commercialization of scientific elaborations as a factor of competitive development of entrepreneurship* Bulletin of the Taras Shevchenko National University of Kyiv **148** 245-51 (in Ukrainian)
- [4] Pavlenko V G 2010 *Foreign experience of commercialization of intellectual property* Human. Community. Control. **1** 134-41 (in Russian)
- [5] Samilo A V, Povstyn O V, Kupchak M Ya 2013 *Theoretical bases of commercialization of the results of scientific and technical activity of the civil service of Ukraine for emergency situations* Visnyk of the Lviv State University of Life Safety **7** 285-90 (in Ukrainian)
- [6] Prokhorov A N 2011 *Foreign experience of the process of commercialization of intellectual property* Bulletin of the Tyumen state University **11** 66-70 (in Russian)
- [7] Bazilevich V D 2014 *Intellectual Property* V.D. Bazilevich; 3rd issue, reworked. and complemented K.: Knowledge 671 (in Ukrainian)
- [8] *Resolution of the Cabinet of Ministers of Ukraine On the approval of the list of paid services that may be provided by educational institutions, other institutions and educational establishments belonging to the state and municipal form of ownership* (August 27, 2010) **796 E-resource:** <http://zakon2.rada.gov.ua/laws/show/796-2010-%D0%BF#n17> (in Ukrainian)
- [9] *The Law of Ukraine On Higher Education* Version 01.01.2018. **1556-18 E-resource:** <http://zakon3.rada.gov.ua/laws/show/1556-18/page3> (in Ukrainian)
- [10] *The Law of Ukraine "On Science Parks" of 25.06.2009.* **1563-VI E-resource:** <http://zakon3.rada.gov.ua/laws/show/1563-17> (in Ukrainian)
- [11] *The Tax Code of Ukraine: the Law of Ukraine (2755-VI, 02.12.2010)* **E-resource:** <http://zakon5.rada.gov.ua/laws/show/2755-17> (in Ukrainian)
- [12] Bay S I, Doskonala I A 2012 *Commercialization of scientific elaborations of the University R&D: Problems and Solutions.* Bulletin of the Khmelnytsky National University **3**(1) 215-20 (in English)
- [13] Bogolib T M 2014 *Commercialization of scientific elaborations of universities] Ukraine`s economy* **1**(618) 33-50 (in Ukrainian)
- [14] Fedorov M V, Peshina E V 2012 *Pentahelix is the concept of knowledge production in an innovative economy* *Management* **334** 4-12