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DEVELOPMENT OF INNOVATION ACTIVITIES WITHIN KNOWLEDGE TRIANGLE "GOVERNMENT-UNIVERSITY-INDUSTRY"

Article presents the methodological and analytical generalization of the modern practices of the institutional ensuring of the organic cooperation in frame of innovation cycle by the government, Universities and industries. The "Triple Helix" innovation mode is considered in order to undertake the international comparative analysis of Ukraine's competitiveness according to appropriate indicators. Author proposes to improve the Ukrainian current innovation policy through the creation and supporting the special institutional measures regarding to enhancing the interaction between the government, Universities and businesses.

The core of the proposed conceptual model is the Schumpeterian theory of economic development and its policy implications in the economically successful countries which have become such because they constantly generate new commercialized knowledge in the forms of process and product innovations. Therefore, dynamic and successful countries consider the transformation of institutions that promote the development of knowledge and innovation potential among the immediate reform measures. It concerns the reform of the institutions of education and science, infrastructure of transfer of innovative technologies, supporting innovation in all areas of life, providing a major international integration of the country to the world educational, scientific and innovative ecosystem.

In order to realize such approach, the developed countries have transformed the forms and methods of innovation policy by building the new effective managerial and organizational conditions to activate the processes of generating and commercializing innovations through changing their innovation mode: from the "linear" model of innovation cycle to the "cooperative" one, i.e. to the "Triple Helix" mode. These methodological and practical transformations have changed radically the role and significance of the forms of interaction between institutions of science, education and business in the innovation process and have raised the role of Universities. This led to the formation of a new type of University – Entrepreneurial University.

It is important to create in Ukraine a special institutional background to build a "cooperative" model innovation cycle, to develop and adopt regulations that will promote processes of self-organization in the area of innovation cooperation of research institutions and Universities on the one hand, and business and government agencies - on the other. In this context the problem of greater autonomy for Universities becomes very urgent. Also, this autonomy can help ensure a greater diversification of the sources of funding (through commercial relations with businesses and government agencies under innovation cycle) and to become more flexible and mobile in answering the challenges of external market environment.

Key words: University's innovation policy, "Triple Helix" concept, innovation cycle, innovation ecosystem "Government – University – Industry", Ukraine's economy.

J E L : I25, O25, O32, O38

Today, more and more governments worldwide are using the J.Schumpeter's conceptual model of innovative economic development as a practical roadmap in the formation of national strategies and current socio-economic programs. Here are two examples. A research by analysts of Davos World Economic Forum, who annually publish a detailed comparative analysis of international growth potential



named "Global Competitiveness Report" revealed that, in the XXI century, all developed countries with a national per capita income over 17,000 USD are innovative countries [1]. The European Union in XXI century officially adopted two strategies of growth - the Lisbon strategy (for 2000-2010) and the following strategy "Europe 2020" (for 2010-2020) [2]. Both of these strategies are completely focused on the development of knowledge and innovation factors as the main power to ensure continuous rise of welfare in the united European countries [3].

The methodological core of this conceptual model is the realization that the country's ability to constantly generate new knowledge and implement their commercialization in the form of technological and product innovation is a central factor in its competitiveness. So dynamic and successful countries consider the transformation of institutions that promote the development of the knowledge and innovation potential among the priorities of reform measures. This concerns the reform of the institutions of education and science, creation of the infrastructure for transfer of innovative technologies, support of innovative activities in all areas of life, and the provision of a large-scale international integration of own country to the educational, scientific and innovative global space. Many countries have formed special national [4] and regional [5] innovative systems, and analytical monitoring of innovative processes is continuously under way [6].

Recently, however, in this area, a certain methodological and practical transformation on the forms and methods of innovation policy has taken place, and a new effective management tools and organizational conditions have been constantly emerging for the revival of the generation and commercialization of innovations. The result is a change of the model of the management of innovation processes: from the "linear" model of innovation cycle to its "cooperative" model or so-called "triple helix" models. This methodological and practical transformation has radically changed the role and significance of the forms of interaction between the institutions of science, education and business in the innovation process and increased its role in Universities. This leads to the formation of a new type of University, namely a business University. Such higher education entities are already playing a central role in national and regional innovation systems of the intelligent economies of developed countries.

The theoretical generalization of this phenomenon is associated primarily with the name of a Stanford University professor Henry Etzkovitz [7], who together with L.Leydesdorff proposed the "Triple Helix" concept of innovation cycle, which is the institutional basis of three organic entities in the process of creating innovation as a metaphorical spiral consisting of: the authorities (both central and local), business structures and Universities. The latter, in this model, play a central role in ensuring the efficiency of the whole innovation cycle.

Ukrainian literature provides many examples of successful implementation of the "triple helix" model in the cooperation between Universities, enterprises and governments in various countries. [8] An interesting investigation on the Japanese example, in this context, has been made by N.Halan [9], who revealed the essence of this approach, noting that, in a knowledge based economy, the presence of double helices, that is, interactions between the state and the market, and between science and business is insufficient. Today, Universities and research institutions begin to perform some business functions, creating special centers for commercial-



ization of innovations and small venture companies. As a result of those developments, educational and scientific institutions whose main mission is the production and dissemination of knowledge are, in fact, turning into businesses.

However, in Ukraine, one can observe as a lack of awareness in both the scientific and political communities about the theoretical essence and practical significance of the above mentioned conceptual transformations, and lack of proper attention to these processes in Ukrainian reform measures. In particular, it was revealed in the preparation and adoption, in 2014, of the new Law of Ukraine "On Higher Education" [10], where there is no mention of the entrepreneurial University and there are no rules of institutional support for innovation, which could contribute to the emergence of similar Universities in Ukraine. A novelty of this law is the legal introduction of the status of a research University, but as we show below, today it is already a past stage in the evolution of Universities, the phase, which still reflects the implementation of the "linear" model of innovation cycle.

This article aims to reveal the features of the emergence of the "cooperative" model of innovation cycle and the corresponding formation of entrepreneurial Universities, to make a methodological and analytical generalization of the modern experience of institutional support for organic cooperation between the state, Universities and businesses in this model, to perform an international comparative analysis of this model's application, and define the Ukrainian context, including the assessment of the current state of the corresponding processes.

From "linear" to "cooperative" model of innovation cycle

The "cooperative" model innovation cycle actually summarizes the new management approaches that have emerged in the last decade. The essence of these novelties is due to the above mentioned transition, in theory and practice, from the "linear" model of innovation cycle, when the institutions of science, R&D, production and sale of innovative products and services exist and operate relatively independently from each other, to the matrix based "cooperative" model when these institutions seamlessly interact in the feedback mode not so much within the traditional linear transfer of technologies, but rather within a collaborative generation (creation) and simultaneous commercialization of innovative technologies and products. Actually an example of such a matrix based model is the above mentioned "triple helix" model. The development of this area of innovation management is also driven by the growing complexity of production, technology, and business patterns, which creates new cooperative relationships between Universities, business and government both domestically and globally. [11] In a direct way, that has affected the current institutional model of the University, which has changed in response to the above trends.

In the "linear" model, innovation cycle is implemented by successive stages, for each of which is created a separate institutional support. Fundamental and applied research is mainly conducted at Universities (in Ukraine, it is a variety of higher education institutions) and specialized research institutions (such as institutes of the National Academy of Sciences of Ukraine), technological designs and prototypes are mainly elaborated by the specialized sectoral R&D technological organizations and by the enterprises (enterprise science), and commercial implementation of



completed projects (emergence of innovation as such) is provided by special institutions for technology transfer and by individual enterprises.

In this model, there is a problem of special institutional support for the "transmission" mechanism of transition from scientific development to commercial implementation, i.e. the transfer of the results obtained at each stage, further along the chain of innovation cycle. When implementing the "linear" model, there has been a recurring issue when the research work, which is done and finished at one stage, does not take into account the peculiarities of the further stages and therefore did not advance towards the final result, i.e. commercialization of scientific and technological achievements, i.e. their transformation into innovations.

When the innovation cycle was quite long, the intermediary organizations engaged in technology transfer mitigated the conflict between the stages and provided a more or less complete innovation cycle. Today, when the dynamism of economic processes has significantly increased, and globalization has caused an unprecedented increase in international competition, the long duration of the linear innovation cycle becomes an obstacle to its full completion and shows its inability to flexibly respond to the dramatic changes of the modern consumer demand.

As analysis shows, in Ukraine, transfer of innovative technologies has always been a weak point of the national innovation system, which fails to provide a sufficient commercializing of scientific advances and technological developments. The reason is both the administrative and command tradition in the management of Ukrainian educational and scientific sphere and the support for the managerial and organizational patterns oriented to the "linear" model of innovation cycle. This leads to significant discrepancies between the existing large number of completed scientific projects and received domestic patents and a very low percentage of their commercialization. This is explained, on the one hand, by the fact that the owners of patents and results of scientific research (scientists, teachers, inventors, and companies and organizations, especially government funded ones) are not oriented to specific needs of the enterprises, and, on the other hand, by a very low business demand for innovation. Therefore, in our Universities and research institutions, science often works for the sake of science without proper commercialization of the results. So there is an urgent need to harmonize the relations between business and society and the creators of scientific and technological advances in the form of joint innovative activities.

Today in international practice, this problem is solved through the "cooperative" model of the innovation process, where different stages of the above mentioned cycle are combined in a system of organic cooperation with a simultaneous execution of scientific and applied research and with particular focus on the conditions and requirements of the particular stage of research implementation. With the "cooperative" model, the probability of achieving commercial success of scientific and technological projects significantly increases. But this is not the only reason why the modern managerial research focuses towards the development of the "cooperative" model of innovation.

Practice has shown that the above mentioned combination of all participants of the innovation-generation cycle creates an extremely effective creative environment for massive emergence of innovative ideas that are directly targeted at the commercialization stage. This contributed to the rapid institutional development of so-called



spin off or *spillover*¹ organizational forms of the implementation of the "cooperative" model exactly in the University where this effect can be the most productive. Especially high innovative performance in this field was demonstrated by "creative clusters" that arose on the basis of University science, uniting, in the creative process, the scientists, teachers, students and research customers from businesses or government agencies. This largely changed the traditional institutional model of higher education. There appeared a new type of University, namely business Universities, which are also called the Universities of XXI century. [12]. They, in turn, became systemic organizational centers for new spatial research-and-production regional clusters.

The following examples have become paradigmatic: Massachusetts Technological Institute began its path to global leadership, when, during the Great Depression, it made an offer to businessmen and state authorities to apply a new, proper "cooperative" model of economic growth in the region. For its implementation it was necessary to expand research not only in fundamental, but also in applied sciences. In the West of USA, Stanford and Berkeley Universities (California), organizing a creative collaboration of the best scientists and professors from large corporations, with the participation of the Pentagon, created one of the largest centers in the world of high technology, "Silicon Valley". [13] In the same methodological format, appeared the concepts development programs of "Intelligent Regions" [14] "Creative Knowledge Cities" [15] and "Science Cities" [16]. Such a managerial approach was the most successful as to providing an effective process of creation and commercialization of innovations.

From University models I and II to the model of "Entrepreneurial University"

Traditionally, discussions on the functions of the University as institutional structure have focused on two models that formed and evolved in the time dimension.

Model I. Universities have two functions: training and exploratory research, being these functions almost entirely financed the state. In this case, the results of University research have the status of "public good" and belonging to all interested users.

Model II. Universities and businesses have close relationship that allows them to establish communication feedback mode. Universities try to focus on the demand of enterprises both in terms of the qualification of their graduates and in research. In this model, both Universities and enterprises benefit from such cooperation. The state continues to be a major source of funding for Universities, but private business is added in this role.

In fact *model I* is a "linear" model of innovation cycle and so remains in case of commercialization of the relationship between institutions belonging to different stages of the innovation cycle. In this case, a conflict may arise in the context of protection of intellectual property rights between scientists and manufacturers. The institutions that finance different stages of the innovation cycle, waive claims to royalties, especially in case of public funding. If the state funds a research, it emphasizes its right to have an income in the event of commercialization of its results. Then researchers (from public Universities and government organizations) almost

¹ The English categories *spin off* and *spillover* have entrenched in the literature as not translatable. They mean the emergence of multiple additional innovations indirectly triggered by the influence of a certain innovation, which is the main subject of managerial action. The essence of this phenomenon is similar to the famous category of "positive externalities" in economic theory



completely lose their economic incentives to further commercialize their scientific achievements. This conflict showed itself especially acutely in the former Soviet Union, during the transition from command to market economy. For example, in Ukraine under the current legislation, commercialization of scientific and technological achievements obtained with budget funding could take place only on the permission of the State Property Fund. State Universities have no right to sell scientific and technical products generated by their employees in the walls of these institutions. The legislator has plans to improve this situation, but they are not yet implemented.

A similar problem arises in the case of model II. Although this model has feedback and hence becomes nonlinear, economic and financial activities of each institution in the triangle "University - company – state" is autonomous and, in fact, cooperative relations of all participants of the innovation cycle are within the "linear" model (with buyer and seller of scientifico-technological products).

The said conflict has arisen in many countries, including the classic market economies. The first example of its solution was shown in the USA, where, in order to address the problem, a series of legislative documents were adopted during the preparation of effective institutional reforms. This reform was "led" by the adopted in 1980 well known Bayh-Dole Act [17], which made possible the purchase, by small enterprises and Universities, of patents on the results of scientific and technological activities financed from the state budget. This Act allowed Universities to have the right to intellectual property on the results of scientific and technological developments are financed from the state budget, and the exclusive right to license inventions. This change in legislation contributed to the rapid increase in the number of innovations both in academia and for small and medium businesses. For example, over the subsequent decade, the number of patents received by the academic institutions of University in the USA increased by 300% [18].

Similar improvements of national legislation were also made in other countries. A practical institutional result was a sizeable increase in the number of University transfer centers, and the emergence of a new priority, namely the creation of spin-off companies and the growing interest of governments (central and regional ones) in increased spending on R&D activities at the Universities, which began to consider commercialization of new knowledge created in University laboratories as a way to obtain increased public funding.

The literature provides many examples of the positive effect of this Act in the USA [19] and shows its role as a catalyst of positive change in other countries. K.Kalantaridis mentions positive examples the following countries where such mechanisms were established to support and enhance innovation activities: in the UK in 1985 [20]; in Spain in 1980 [21]; in various European countries in the late twentieth century. [22]; in Japan in 1999 [23]. But the search for improvement of the "cooperative" model continues [24].

However, it should be noted that, even with the new laws, there remains the problem of institutional gaps between the stages of innovation cycle, when scientific and technological products of each of them can be used as a complete result, but there is a risk of loss of the final innovative result (commercialization of the new idea). Therefore, the search for optimizing the above mentioned relations between the participants of innovation cycle continued and led to the concept of the



"triple helix" where innovation should be created in the organic cooperative interaction between the parties of the "knowledge triangle" "Universities - Business – Government".

The first researchers of this model H.Etzkowitz and L.Leydesdorff showed the historical evolution of the cooperative model of innovation cycle via its three configurations [25], the latter of which actually was named "triple helix". The central concept of this model is the "entrepreneurial University", which serves as the main engine of the movement from the industrial to knowledge based economy. As revealed in the literature, academic entrepreneurship combines the educational and research missions with innovation [26]. Shaping of the new concept of the innovation process took place under the influence of both exogenous and endogenous factors [27].

Among the exogenous factors of the cooperative model, one should first of all mention such effects as the closure of traditional industrial enterprises during the crisis and the need to develop high technologies for the creation of new industries and therefore new jobs, changes in the modes of legal protection of intellectual property, and increasing dynamics of innovation processes.

Endogenous factors are related to the inner transformation of the Universities towards obtaining the best opportunities to commercialize their scientific achievements, competition between Universities (public and private) for funding sources, emergence, in the Universities, of mixed business-and-research groups, which actually became quasi-branches with all features of small non-profit companies, development of interdisciplinary research, attempts to create their own businesses in order to reduce the direct dependence on existing donating government and business financial institutions.

The combination of the said exogenous and endogenous factors led to the emergence of entrepreneurial Universities whose models originally evolved under the influence of the "*first academic revolution*", which added, to the University's mission, research process, expanding in so doing the primary mission of education. The research component became an integral part of many disciplines. Then the "*second academic revolution*" took place when University education was seen among the major factors of socio-economic development. The practical function of the educational and research processes that began to intermingle closely together becomes a principal one not only as demonstration of the possible ways of the real use of scientific results or knowledge gained, but as human capital that brings sizable economic benefits for Universities and countries. The new customers and users of the Universities' innovative products were a wide range of stakeholders, such as government institutions, and representatives of business and public sectors.

Over time, the practical implementation of this function increasingly took place in the mode of cooperative interaction of all stakeholders. Enterprises began to use University R&D infrastructure to solve their problems of innovative development, which actually led to their cooperation with the government in dealing with the problem of the Universities' financial security [28]. In the system of cooperative relations between the actors of the "triple helix" model, Universities began to play a central role as an institution generating new knowledge, which is consequently commercialized. [29]



Compared to traditional Universities, which are often identified with the ancient Chinese metaphor of an ivory tower, an entrepreneurial University provides the following competitive advantages:

The opportunity to effectively teach the students new ideas and entrepreneurial abilities, and develop their talents, which is their main asset in the modern intellectual economy.

- student becomes not just a new profession for some modern industry, and at the same time can be a real entrepreneur, to found his own company and thus directly contribute to the economic growth of the country.
- entrepreneurial University has an additional direct impact on economic development through special programs and organizational forms for continuous business education and the generation of new business structures, such as short-term interdisciplinary programs, science parks, incubators, etc. [30].
- entrepreneurial Universities have a unique opportunity to generate innovative technologies, nurture creativity, and create new cooperative forms of technology transfer, which are caused by objective business needs, and not by subjective informal ties.

Analysts define such features of an entrepreneurial University [31] as: formation on its basis of authoritative scientific center that generates new projects and scientific-and-educational products with a fast passage of the commercialization stage and access to the market, and involves additional sources to finance the higher education institution as a complement to traditional sources. This additional funding appears in the process of working closely with local authorities on the performance of educational, research or advisory services to private enterprises and as income from their shares in the authorized capital of companies. This type of University is called design-oriented [32]. This University already is an economic corporation that produces knowledge, and individual faculties and departments have the opportunity to test their competitiveness on the market and receive income from this, which is used mainly on funding the University's development. In this context the entrepreneurial Universities begin to implement a new mission, namely providing knowledge, favorable conditions and support for the entry of students, graduates and professors to the world market with their own start-ups and innovative companies.

Studying the international practice of the operation of "triple helix" model shows that institutional support of the knowledge component in this model can be represented in different ways. Typically, it is research departments or special organizational forms within Universities, such as science parks, technology parks, incubators, as well as such separate entities as research institutes, laboratories or centers. These forms can closely interact with each other and form mixed institutional units. The legal status of such organizational structures sufficiently differs in different countries and individual regions. They can be called technology transfer centers, business incubators, technology parks and so on. At the same time, all such organizational forms are focused on achieving the cooperative common goal of providing innovative progress of the University, which initiates the implementation of its own scientific results in the economy and, in partnership with government and business, contributes to the creation of new innovative companies (startups)



with participation of its researchers (professors), students, PhD students, fellows, and alumni. Especially successful is the practice, when there still are no businesses willing to implement newly developed designs.

The most typical institutional forms of "triple helix" model are venture capital partnerships created at Universities or research institutions - special organizations working with high technologies (*spin off*), institutions working to support traditional research institutions such as regional technology transfer agencies, whose task is to organize interaction between a company and a public research institution, dissemination of technological know-how in individual sectors and so on. For the legal regulation of this sphere, in the advanced countries, new special techniques to stimulate the development of innovation at Universities have been created. In particular, in the USA, various laws have been adopted that support and protect "venture capital activities" in the creation of high-tech businesses. Also, the entry of high-tech companies to the market is actively supported by the NASDAQ stock exchange (National Association of Securities Dealers Automated Quotation).

Awareness of the existence of these types of innovation cycle models and the importance of University institutions that are the backbone conceptual core of the modern cooperative systems of innovation management is important for further empirical analysis of the actual state of the state management system "state - University - industry" in terms of the efficiency of public policies to stimulate innovative activities.

Evaluating the effectiveness of Universities in the innovation process

Measuring the impact of the innovative cooperation of Universities and businesses on economic development has been a subject of economic research and a component of the characteristics of national competitiveness and the productivity of national and regional innovation systems. Although it has been long recognized that the University is a powerful source of new knowledge that are commercialized through innovation, there are many discussion points as to the measurement of the economic efficiency of such transmissions.

It has been found that it is quite difficult to statistically demonstrate the overall economic impact of University research funded by the state [33]. Besides, most empirical evidence is based on certain assumptions, which narrow the object of study, or on case study analysis that reflects only a particular context or situation, and is often unable to provide generalized conclusions. That makes it difficult to produce standard methodological guidelines, which can then be implemented in the regulations. Another challenge is to determine the innovation as an object of commercialization, because the content of innovation may widely vary by different Universities and by different countries. However, we can cite the example of the developed econometric models which prove that either academic research has high yield [34] or commercialization of the achievements of University research is one of the major driving forces of economic growth. [35]

The phenomenon of cooperation between Universities and businesses in the innovation process is reflected in the country competitiveness indicators in the annual analytical reports on global competitiveness compiled by a research group at the World Economic Forum Davos (Switzerland). In the 12th chapter dedicated to in-



novation, a special indicator of "University/industry research collaboration" is featured. The value of this indicator is determined as the average of expert estimates of the said phenomenon in the range of 1 to 7 (1 = no research collaboration; 7 = such cooperation is quite extensive). In Table 1, we present the results of such an evaluation for selected countries with the aim to compare them with Ukraine. In the table, we have identified two groups of countries. The first one includes dynamic countries that managed to provide a dynamic development and entered the pool of developed countries, starting from a relatively low position in the world rankings (some were even in a worse position than Ukraine is now). The second group represents countries of Central and Eastern Europe, which can be regarded as direct analogues for Ukraine, because they had about the same initial conditions in the transition from command to market economy.

Table 1

Indicators of the cooperation between Universities and businesses in the innovation process in selected countries and in Ukraine according to the rating of competitiveness compiled by analysts of the World Economic Forum in Davos (Switzerland) in 2013

Selected dynamic catching-up countries	Ranking (place)	Points (1-7)
Finland	2	5,8
Singapore	4	5,6
Israel	8	5,4
Taiwan, China	11	5,3
Ireland	13	5,2
Republic of Korea	26	4,7
Countries of Central and Eastern Europe		
Lithuania	28	4,6
Czech Republic	35	4,4
Estonia	36	4,4
Hungary	41	4,3
Slovenia	56	3,8
Russia	64	3,6
Latvia	67	3,6
Poland	72	3,5
Ukraine	77	3,4
Slovak Republic	93	3,3
Romania	88	3,3
Bulgaria	117	3,0

Source: The Global Competitiveness Report 2013–2014 / World Economic Forum. – Geneva, Switzerland. – available at: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2013-14.pdf

As one can see from the Table 1, all countries are characterized by a high rating of the cooperation between Universities and industry in research projects. The same picture can be observed for all developed countries. Among the countries of Central and Eastern Europe, Ukraine finds itself among the outsiders, losing much in this parameter to such successful in transition processes neighboring countries as the Czech Republic, Hungary and the Baltic countries. However, our 77th place



with 3.4 points of expert estimates is not very different from Poland and we are ahead of Slovakia, Romania and Bulgaria. From this one could conclude that things here are not so bad, but it is important to evaluate the effectiveness of such innovative collaboration. In Ukraine there are indeed historically close ties between Universities (especially technical ones) and companies for which they train personnel, but this cooperation, firstly, takes place mainly within the previously mentioned "linear" model of innovation cycle, and, secondly, it is the stage mass commercial introduction of scientific designs that has always been the weakest spot. Quite a number of completed research work usually fail to find commercial application.

The analytical database presented in the "Global Competitiveness Report" allows a detailed analysis of Ukraine's global competitive position in terms of effectiveness of the final stages of the innovation cycle, i.e. commercialization of innovative and technological knowledge. The traditional "linear" model of the cycle, when control systems for each stage are constructed separately arranged for its various stages ("education – R&D - technology - pilot production - mass production", is now rightly criticized for focus on the R&D rather than on the final result which is commercial introduction of the innovation. The development of individual stages cannot guarantee the achievement of the desired final result, which is the conversion of existing knowledge into a factor of economic growth. This situation can be clearly identified in Ukraine by means of the ratings given in the Global Competitiveness Report.

For this purpose, we arranged certain indicators used to construct aggregate competitiveness index by different stages of the innovation cycle. Then we compared the rank of the countries by each indicator in order to assess the degree of development of each stage and to compare the resulting values. Such analysis can be used to compare the situation in different countries as well. In this article we compare the following countries: Ukraine, Poland and Estonia as direct analogues, and Finland - as a recognized world leader in building innovative economy and a country that was able to very rapidly go from a European outsider to the first places in the ranking of global competitiveness. Each stage of the innovation cycle is introduced by indicators reflected in Table. 2.

To better visualize the analytical data, we are presenting data from the table as a graph in Fig. 1. For this purpose, we presented each stage of the innovation cycle as an average of five ranking indicators.

On Fig.1 one can clearly see how Ukraine's ranking place is reducing at each production stage of the innovation cycle. If at the stages of education and R&D we are about the same level with Poland, at the final stages of the cycle, which should provide innovative commercial result, there is a lag. The data on Finland, the world leader in building knowledge based economy, and Estonia, the innovation leader among the CIS countries, both point to the importance of achieving a proper balance at all stages of the innovation cycle. The data also suggest the need for organic interaction between all stages of the innovation cycle, when all actors work in concert for the final innovative result in the mode of constant feedback between the stages. In this methodological perspective, becomes clear the fallacy of the policy of separate guidance of individual stages of the innovation cycle which is now the case in Ukraine. On the other hand, also clear becomes the trend in state innovation policy of developed countries, which is associated with the transition to "triple helix" model of the innovation process.



Table 2

Ranking of selected countries by components of the stages of innovation cycle by analysts of the World Economic Forum in Davos, 2013

Indicator	Finland	Estonia	Poland	Ukraine
Stage of higher and professional education				
1. Availability of higher education	2	30	19	10
2. Quality of the educational system	2	47	87	79
3. Quality of education in mathematics and natural sciences	2	26	69	28
4. Quality of management schools	10	54	89	115
5. Availability of research and training services	6	36	33	92
R&D stage				
6. Innovative potential	2	28	62	100
7. Quality of research institutions	10	25	55	69
8. Availability of researchers and engineers	1	95	66	46
9. Cooperation between Universities and business	2	36	72	77
10. Use of patents	3	26	40	52
Stage of innovative management				
11. Type of competitive advantage	3	60	95	112
12. Companies' R&D costs	3	45	103	112
13. Cooperation between Universities and business	2	36	72	77
14. Complexity of production process	4	53	51	97
15. Use of patents	3	26	40	52
Stage of commercialization of knowledge				
16. Absorption of technologies by companies	7	36	114	100
17. Foreign investment and technology transfer	86	31	75	131
18. Availability of advanced technologies	1	35	102	106
19. Use of patents	3	26	40	52
20. Stage of development of the clusters	12	80	104	136

Source: The Global Competitiveness Report 2013–2014 / The World Economic Forum. – Geneva, Switzerland, 2013. – P. 181, 185, 317, 377. – Available at: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2013-14.pdf

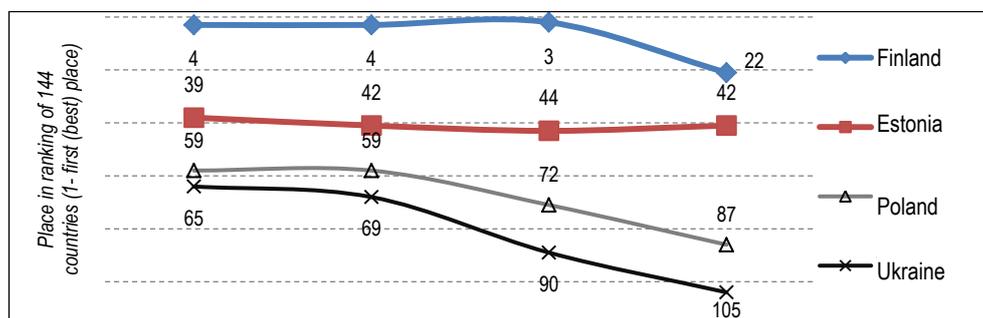


Fig. 1. Places in the ranking of the Global Competitiveness 2013-2014 by indicators of different stages of the innovation cycle (average of five ranking indicators of each stage (see Table. 2))

Source: The Global Competitiveness Report 2013–2014 / The World Economic Forum. – Geneva, Switzerland, 2013. – P. 181, 185, 317, 377. – Available at: http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2013-14.pdf



Conclusions: improving innovation policies of Universities

Analysis of the concept of "cooperative" model of innovation cycle, including "triple helix" model, which creates new opportunities to improve the process of commercialization of scientific and technological designs, allow concluding that cooperation of the institutions in sphere of science and education with business enterprises, as well as with innovation and financial infrastructure agencies is efficient, if the purpose of this process is the establishment of a dynamic system of commercialization of science intensive high tech products. World practice proves that today the "third mission" of educational and scientific institutions is being shaped and implemented, namely the commercialization of R&D that leads to the emergence of a new type of Universities - entrepreneurial Universities that perform specific business functions, such as creating centers for commercialization of innovation or small venture companies (start-ups).

Today, the world's leading Universities dynamically carry out institutional transformation to realize the model for "triple helix" - they have turned into powerful business academic centers that develop and produce new scientific and educational products, which quickly enter the market. Central to their work is the generation and transfer of innovative technologies in the process of commercializing of the research results, which also becomes an integral part of the educational process. As these Universities are interested in getting added value from commercializing their R&D designs, they contribute to the development of the project from concept to innovative product or high-tech enterprise.

It is important to create in Ukraine a special institutional support to form the "cooperative" model of innovation cycle, and to develop and adopt regulations that would facilitate self-organization in terms of innovative cooperation between research institutions and Universities on the one hand, and business and government agencies on the other hand. In this context, a new sense appears in the issue of greater autonomy for Universities, which gives them more opportunities to carry out such activities in terms of diversification of funding sources (through the development of commercial relations with businesses and government agencies in the sphere of innovation) and to become more flexible and mobile to changes in the external market environment.

In this context it is also appropriate to give the Ukrainian Universities greater financial autonomy. This would allow them to speed up the execution of financial operations and avoid long bureaucratic procedures. An additional motivation for scientific research and its commercialization would be ensured by granting more rights to Universities on the basis of the democratic procedures of self-government and distribution of incomes earned from contract research, and revenues from the licensing of intellectual property and commercialization. According to international practice, some of these funds are usually aimed at creating and improving the Universities' centers of technology transfer, science parks, to support R&D activities and patenting, participation in international projects, updating the material base of research and so on. The frame opportunities are incorporated in the new Law of Ukraine "On Education", but, in order for the declared financial autonomy of the Universities to become reality, it is necessary to develop and implement many



normative documents, including those supporting exactly the "cooperative" model of creating innovation and high-tech startups.

More freedom of action in innovation for the Universities allows them to use such promising funding sources of the processes of commercialization of scientific achievements as those provided by venture investment institutions. Another source of funding for the commercialization of innovations is the special investment funds whose activities would be focused on investing in potentially profitable innovation projects. This practice is common in developed countries and helps get the maximum benefit from the scientific and technological designs. In particular, the laws "On Venture Funds of Innovative Development" and "On Venture Investment Companies" whose drafts have been prepared can give impetus to the revival of innovation and commercialization of scientific designs in Ukraine, both for companies and for higher education.

From the analysis of the practice of innovative activities of world-class Universities one can also conclude that, for starting new companies based on University research and licensing, on their own behalf, scientific and technological designs, it is very important for such companies is to build a specific innovative ecosystem, both in the University and in the region and country, which would contribute to the development of venture businesses based on the implementation of managerial models of open innovation. At the heart of such an innovative ecosystem would be the intermediaries engaged in the selection of new technological solutions, searching for knowledge sources, establishing links between these sources (which are mainly located in research institutions and Universities), and in the development and implementation of innovative strategies for businesses. In Ukraine's Universities, on the example of the models of the commercialization of innovations in the world's leading Universities, it is necessary to create an effective regulatory framework for the formation of relevant departments and centers, giving them a certain financial autonomy in the structure of the University.

Such centers allow to flexibly response to changing external factors to reveal the researchers' potential and to raise their motivation for the quality of research, to find ways of the University's development by providing commercial educational and advisory services, and by commercialization of research activities. A key focus of this process may be improving the existing nationally system of licensing technology transfer centers at Universities towards their further transition into self-supporting assuming the functions of guiding the innovation cycle in the "cooperative" model of the knowledge triangle of "state - University - industry". Infrastructure support for such a management model may be also organized at the national and international levels.