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# EUROPEAN CHALLENGES FOR UKRAINIAN INNOVATION POLICY AND TECHNICAL UNIVERSITIES

*The article deals with problems related to research excellence for innovation and their societal impact, «brain drain» and the formation of entrepreneurial ecosystems. These problems already exist in Ukraine, but they can become exacerbated on the way of its integration into European structures, if the innovation policy does not change. The indicators of research, development and innovation activity in Ukraine and experience of several EU countries are analyzed. The recommendations of the Horizon 2020 Policy Support Facility Panel (2016) and the proposals of the European League of Research Universities (2017) are considered.*

*It is proved that these problems in the process of the European integration movement are exacerbated and can be considered as challenges for the national innovation system and for individual universities. However, it is noted that Ukraine can use the existing positive experience of European countries to overcome similar problems. At the same time, new policies and management will have to counteract the existing approaches, it is also necessary to make changes in the legislation.*

*In order to overcome these challenges, it was proposed to implement public policy and management measures that were proposed in the author's previous work, in particular to carry out assessment of scientists according to the UK experience, but somewhat simplified, and to introduce a performance based funding system.*

***Keywords**: innovation, challenge, entrepreneurship, research & development, research excellence, societal impact, brain drain, entrepreneurial ecosystem.*

**Introduction.** In recent years Ukraine has been actively implementing the European integration policy, a part of which is the entry into the European Higher Education Area and European Research Area. Some ways of developing science have been determined, although its reformation actually does not take place. It is necessary to talk about radical changes in the reform of the national innovation system and Ukraine's acquisition of a proper place among the developed European countries. However, on the way to transform the National innovation system (NIS) there are challenges related to the non-compliance of Ukrainian realities with the standards and potential of developed socio-economic systems of both European leading countries and those who are successfully approaching them.

Ukrainian NIS and especially R&D policy was studied by the independent panel of Horizon 2020 Policy Support Facility (PSF) [9]. The PSF panel defined thirty recommendations and seven policy messages to the Ukrainian government. Among the messages [9, p. 8]: Science, Technology and Innovation Strategy should be provided in order to innovate the path to growth; the principles of «scientific excellence and on opportunities for innovation-driven economic growth» should be realized.

The recommendations of the PSF panel are largely linked to plans for the integration of Ukrainian institutions into the European Higher Education Area and European Research Area. However, implementation of these plans has difficulties. At the same time, in our opinion [2], the considerations in the documents of the PSF panel regarding the quality of Ukrainian legislation in the field of science are too optimistic. Even more doubt is caused by the willingness of state policy managers to implement them in contradiction to the negative trends that have developed in the country. However, the conclusions of the PSF panel are very useful for further study of the problems and challenges faced by the Ukrainian NIS in the context of the European integration movement.

Universities are one of the most important elements of modern knowledge economies and societies. As noted by N. Cloete & I. Bunting [6], «In the knowledge economy/society, universities have gained political and economic importance». Therefore, our study will focus not only on the challenges faced by the entire National Innovation System in the process of European integration of Ukraine, but also what these challenges means for universities, in particular technical ones, which take pressure in education, science, technology and innovation areas. Therefore, our study will focus not only on the challenges faced by the entire NIS in the process of European integration of Ukraine, but also on what these challenges means for universities, in particular technical ones, which take pressure in education, science, technology and innovation areas.

**Literature review.** Important events were presentations and publications of studies and propositions worked out by the independent PSF panel of Horizon 2020 [9]. However, the recommendations of the PSF

panel may remain unfulfilled. The situation should be defined as the challenges of «research excellence» and «excellence for innovations» for the NIS.

Ukraine has a strong intellectual human capital. By a group of indicators «High-level skills» of The Global Talent Competitiveness Index (GTCI) 2017 [13] Ukraine ranked the 30th among 118 countries of the world, in particular, according to the indicator of «Labour force with tertiary education» the country ranked as the 7th. However, most indicators of the country's attractiveness for retaining and attracting talent are lower.

According to The Global Competitiveness Report 2017–2018 [26], the Global Competitiveness Index (GCI) «assesses the factors and institutions identified by empirical and theoretical research as determining improvements in productivity, which in turn is the main determinant of long-term growth and an essential factor in economic growth and prosperity». The Table 1 show, that GCI and the capacity to retain and attract talents are low in comparison with the developed countries ones.

Table 1

**GCI, the capacity to retain (R) and attract (A) talents** [24–26]

| | 2015–16, rank out of 140 | | | 2016–17, rank out of 138 | | | 2017–18, rank out of 137 | | |
|---|---|---|---|---|---|---|---|---|---|
| | GCI | A | R | GCI | A | R | GCI | A | R |
| UK | 10 | 4 | 9 | 7 | 3 | 7 | 8 | 3 | 6 |
| Germany | 4 | 19 | 13 | 5 | 16 | 17 | 5 | 13 | 13 |
| Poland | 41 | 126 | 116 | 36 | 116 | 99 | 39 | 113 | 89 |
| Hungary | 63 | 121 | 123 | 69 | 122 | 130 | 60 | 112 | 126 |
| Bulgaria | 54 | 132 | 133 | 50 | 110 | 125 | 49 | 118 | 119 |
| Romania | 53 | 113 | 131 | 62 | 133 | 127 | 68 | 131 | 132 |
| Ukraine | 79 | 97 | 114 | 85 | 93 | 127 | 81 | 106 | 129 |

As P. Kaczmarczyk noted [14], the possibility of employing young and well-educated people is a problem for the Polish labor market. The increasing of accessibility and universality of higher education in Poland can be considered as one of the main achievements, but there is also a decline of education quality and the «overproduction» of graduates on humanities and social sciences in accordance to needs of the Polish labor market. One of the results of the Polish labour market study is that it is need to create highly skilled work places in the country and that «overproduction» of graduates in some areas of science and skills is a source of disproportions.

According to A. Austers [3, p. 57], in sum, Latvia's economy is suffering from emigration. He noted, that «businesses in Latvia will have to adjust to higher labour costs through innovation and productivity enhancement measures, and technological advancement becomes crucial» [3, p. 58].

Summarizing a number of modern studies on migration issues in European countries, A. Schellinger writes [23], that there is a myth that «labor market mobility provides for the necessary adjustment and if there are no jobs in one country, workers will relocate to another with better employment prospects [and] … they will return and – bring with them the experiences acquired abroad. … But it is also equally clear that free movement does not always produce «win-win situations».

Our analysis shown, that the problem of brain drain is a challenge for Ukrainian European integration policy, because the highly-skilled emigration was existed before integrative actions and had multiple, mostly, negative character for the NIS, and could be strengthened along the entering into the European Research Area.

The «excellence for innovation» challenge, factually defined in accordance to PSF panel report [9], should be considered in context of changes, proposed for European R&D system by the League of European Research Universities (LERU) in 2017 [16]. According to the LERU, universities have «responsibility as publicly funded institutions to demonstrate their societal contributions». LERU universities have embraced the notion of impact as part of their core mission, and also have established mechanisms or pathways for impact [16, p. 9]. Nowadays R&D and innovation policy should provide funding programs and expect research proposals, which include statements on societal impact, and focus on building coalitions with nonacademic societal stakeholders. One of the comprehensive approach and definitions of such a broad concept of impact is provided by the UK's Research Excellence Framework in 2014, and some useful recommendation proposed by L. Bornmann & W. Marx [4]. So, the «excellence for innovation» challenge could be considered as «excellence for innovation and societal impact» challenge for Ukrainian universities and the NIS.

There are two contemporary positions as regards to a role of entrepreneurship as the moving force for university. The first one presented by LERU, where: «a pure business model cannot and should not be trans-

ferred to research universities» [16, p. 13]. The second position, presented by H. Etzkowitz [8], B. Clark [5], A. Gibb [10] et al., proposed an entrepreneurial approach as the main for university development. As regards to the rise of technological entrepreneurship on the basis of university research groups, which could be transformed into «spin-offs» [2; 8], there is a problem of such transformation for Ukrainian universities [1; 2]. So, it is a challenge for Ukrainian technical universities to bridge the gap between them and non-innovative local enterprises [2], while the use of an entrepreneurial activity for knowledge transfer into economy and society is ordinary for developed countries all over the world, especially according to the concept of entrepreneurial ecosystems [15; 19; 20].

By the previous research were not defined the concepts of excellent research for innovations in a mix with societal impact and don't study the concepts of entrepreneurial ecosystems forming in Ukraine, and the challenges were not interpreted as the problems for technical university management in context of moving into European structures.

**The purpose of the article** is to determine the essence of the challenges of research quality for innovations and societal impact, highly-skilled emigration and the development of entrepreneurial ecosystems that arise before the National innovation system and technical universities in the process of moving towards Ukraine's European integration in order to improve innovation policy.

**Basic material.** *The brain drain challenge*. We should note that, according to UNESCO statistics [29], Italy in 2015 had approximately 35896.46 GDP per capita, PPP (current international $), while Ukraine – nearly 7915.87. But, as shown [18], the challenge of brain drain for Italy is also a matter of awareness, and Italian propositions for policy measures can be useful for Ukraine. As S. Milio et al. noted [18], Italy is facing a twofold challenge: the emigration of scientifically- and technologically-skilled personnel and poor ability to attract foreign skilled human capital. Among the propositions [18, p. 3]: university reform, targeted investment in scientific research and more substantial collaboration between the public and private sectors. The reform, among others, should contain: reviewing of competitive examinations for academic positions; creation of academic centers of excellence; research funding revision.

The analysis of the International Monetary Fund (IMF) shows [12] the emigration from Central, Eastern, and Southeastern Europe has been unusually large and dominated by educated and young people. It has led to positive outcomes for migrants themselves, and for the European Union as a whole. But such migration processes also slowed economy growth in the «sending» countries, where large-scale emigration has increased wages but worsened productivity. The «sending» countries should ensure the modernization of higher education in order to create «a critical mass of highly-skilled workers that would substitute for those that leave» [12, p. 31], and to strengthen the entrepreneurship environment and to reduce the costs for launching a new business, that would help attract migrants to return.

As earlier proposed by the IMF, the implementing comprehensive and targeted policies could retain and attract migrants and this «could be facilitated by implementing productivity-enhancing policies to raise demand for skilled labor, improving local labor market conditions, and reorienting education» [11, p. 24].

It can be concluded, in accordance with C. Teney [28], that some EU countries suffer from brain drain, while others ones benefit from brain gain. However, more detailed studies shown that such categorization becomes blurred if their contexts and features are taken into account. If the situation in Hungary can indicate a brain drain, the Polish case shows that a more thorough check requires a more accurate assessment of the national contexts. There is a «brain waste» in the country, because the labour market has no evolved so rapidly, as the tertiary education. It is also noted that highly skilled emigration flows can have a positive impact on the overall national educational level. According to C. Teney [28, p. 91], «the magnitude of intra-EU brain drain is one of the consequences of European integration and the creation of a common labour market and brain drain and brain waste thus represents a new EU challenge» which need to be solved.

Ukrainian migration studies mostly used limited data of statistics, and the brain drain and brain waste challenge of highly educated personnel had more general qualitative considerations rather than specific quantitative ones. As L. Semiv & Y. Hvozdovych noted analyzing studies of domestic specialists [27], the main «pushing» factors for young Ukrainians with tertiary education and perspectives in scientific or innovation career in order to leave the country today are: a low salary, lack of opportunities for work according to gained knowledge and skills, housing problems, poor Ukrainian innovation infrastructure and venture capital market.

In general, the EU integration movement of Ukraine can lead to the successful brain circulation and international knowledge transfer if the measures will be taken to retain and attract highly educated and qualified people. We believe that Ukrainian higher education system should be transformed. Certainly, this regards to technical universities, which should strengthen the training of specialists and R&D for the real needs of the economy and society, including entrepreneurship training and high-tech «spin-off» creation, and also ensure the retaining of its own and the attraction of foreign highly qualified academicians and managers.

*The challenge of research excellence for innovations and societal impact.* According to our study [2], eight Ukrainian public polytechnic universities in 2015 had totally of 8736 staff lecturers and researchers and received 23603700 UAH by R&D contracts with industry and grants, an average of 2702 UAH or approximately only 108 euros per scientist throughout the year. So, there exist the problem of R&D performance usefulness for industry and entrepreneurship, and this is the challenge for entering of Ukraine into the European research an education area.

The challenge of *research excellence for innovations* is connected with a fact that scientists, who have long been oriented either toward cooperation with foreign partners or to teach at universities, would to redirect his/her work to the R&D for Ukrainian industry and entrepreneurship.

Among the barriers for excellent practically oriented research the PSF panel is defined [9, p. 14]: lack of incentives to engage in innovation activities; lack of entrepreneurial and innovative culture; insufficient interest in R&D activities of economic actors; lack of awareness and ability of SMEs to innovate; absence of effective channels to convey information between industry, science and education.

The requirements for the social and economic impact of R&D are not new. However, in modern concepts of knowledge production research and achievement results involves a departure from the linear sequence of basic and applied research, experimental development and knowledge transfer. The scheme of knowledge production, derived from the ideas of «Mode 2» [21], involves designing both research and the application of expected results, involving a wide range of nonacademic stakeholders at all stages of R&D: the stakeholders «are part of the network *right from the design* of the research project» [16, p. 17]. Research should be not only excellent, but also focus their attention on economic and socio-cultural issues. Although this approach to individual research is well-known, its systematic application leads to changes in the direction, design, execution and evaluation of results. Bibliometrics and peer review should be changed in order «to be fit-for-purpose in a dynamic, open and networked research ecology» [16, p. 23]. It is proposed the concept of «productive interactions», which should lead to «socially robust knowledge» and relevant applications.

Strengthening the R&D orientation towards the use of results and their social impact requires changes in Ukrainian legislation [2] and public policy, in research funding approaches and also leads to changes in the tasks, regulations and management of scientific, technological and innovation activities at universities, especially technical and technological ones. In a situation where a large number of Ukrainian universities have difficulties with marketing, technology transfer and the implementation of scientific and technological results, the competition in this area with successful universities of developed European countries is a challenge.

*The challenge of entrepreneurial ecosystems*. According to the World Bank report «Doing Business 2018» [30], where the main indicator is «Ease of doing business», the rank of Ukraine is 76, between Uzbekistan (74) and Kyrgyz Republic (77), while the rank of Poland – 27, Czech Republic – 30, Moldova – 44, Romania – 45, Hungary – 48, Bulgaria – 50. If Ukraine has such low indicators of business and innovation, in what sense can it be said that there are innovation systems in the country and entrepreneurial ecosystems?

According to B.-Å. Lundvall et al. [17, p. 225], innovation systems work through the introduction of knowledge into the economy and society. A broad concept of innovation system [17, p. 227] implies a wide set of policies including areas of social, labour market, education, industrial, energy, environmental, and science and technology policy. NIS models may be regarded as the tools to stimulate the economic growth.

If we talk about innovation systems at a region level, the question is not about only a wide definition, but about what should be proposed as «strong» or «weak» regional innovation system (RIS). As P. Cooke et al. noted [7, p. 1577], stronger RSI potential, unlike weaker one, characterized by autonomous taxing and spending (unlike decentralized spending and/or taxation), by regional private finance (contra to dependence on national financial organizations), by control and influence on strategic infrastructure. Stronger RIS also characterized by «embedded» universities, by regional innovation strategy, cooperative culture contra to competitive one etc. Stronger RIS used innovation approach and networking, while weaker one – adaptation and «stand-alone» [7, p. 1580].

As H. Lawton Smith has pointed out [15], this is the weakness of the RIS concept, if we neglect the term «entrepreneurship», because «entrepreneurial activities, together with knowledge development, knowledge diffusion through networks, and market formation, are among the key functions of innovations». H. Qian et al. [22] defined the system of entrepreneurship «as those economic, social, institutional and all other important factors that interactively influence the creation, discovery and exploitation of entrepreneurial opportunities». H. Lawton Smith indicates the difference between «institutional» and «entrepreneurial» RIS. The first one is R&D driven and technology focused, and oriented to user-producer relations, while the last one is venture capital driven, market-focused and generates start-ups.

According to J. F. Moore, «In a business ecosystem, companies coevolve capabilities around a new innovation: they work cooperatively and competitively to support new products, satisfy customer needs, and

eventually incorporate the next round of innovations. … Every business ecosystem develops in four distinct stages: birth, expansion, leadership, and self-renewal – or, if not self-renewal, death. In reality, of course, the evolutionary stages blur, and the managerial challenges of one stage often crop up in another». [19, p. 76].

As X. Neumeyer & A. C. Corbett noted [20, p. 41–42] «The selection and navigation of the optimal entrepreneurial ecosystem has become a crucial component in the entrepreneurial process. Entrepreneurs need to find the best environment to develop their entrepreneurial skills and motivations. Depending on the type of venture they are interested in, they need to select the ecosystem that best provides them with the needed resources – be that start-up capital or the recruitment of new employees – to grow that venture».

Entrepreneurial ecosystems are no longer new phenomena and models, but processes of co-evolution and co-operation of different organizational forms, creating conditions for their effective cooperation in unity with competition open up new opportunities for joint growth. In the context of economies and societies of knowledge, ideas and models of entrepreneurial ecosystems are actively used abroad, in particular in the countries of the European Union. If in Ukraine problematic are the formation of NIS and regional innovation and business systems, is our policy and management ready to perfectly improve the concept of innovative entrepreneurship and legislation, the mechanisms for supporting and stimulating the creation and development of high-tech small firms in the regions?

Even more questions about the development of the «third mission» of universities. In models of entrepreneurial ecosystems, they often play a leading role as higher education centers, knowledge and technology creators, natural business incubators, which implement pre-incubation [1] programs and accelerate the science and technology business.

In our opinion, there are reasons to believe that consistent and systematic introduction of regional innovation and enterprise systems in Ukraine, creation of entrepreneurial ecosystems in accordance with the experience of the advanced European countries is a challenge that needs to be studied and resolved in the process of development on the way of further European integration.

**Conclusion.** The problems related to research excellence for innovation and their societal impact, «brain drain» and the formation of entrepreneurial ecosystems already exist in Ukraine. But ones can become exacerbated on the way of Ukraine's integration into European structures, if the R&D and innovation policy, legislation and management do not change, because the PSF panel expertise and our studies shown the low indicators, negative state of affairs and tendencies.

A significant number of Ukrainian universities, in particular, polytechnic and technological, have not yet reached the European level of excellence in research for innovation. The possibilities of domestic universities to prepare entrepreneurs and create an innovative entrepreneurial environment in the regions are not exhausted. The policy on the use of human resources and the transformation of brain drain migration into the circulation of highly educated people, reducing the losses of their own specialists and attracting foreign ones is not satisfactory.

Considered in our study challenges of brain drain, research excellence for innovations and societal impact, and of entrepreneurial ecosystems are far from the being the only problems of the country's economy and society. However, in our opinion, these very challenges in Ukraine can be thoroughly studied and largely overcome, as we have already mentioned in the results of previous studies [2]. Problems of research excellence, in particular for innovations, could be substantially overcome by the corresponding policy and management measures, especially by using more simple, than in UK, but enough effective research excellence framework and performance based funding.

The system of higher education and public universities should be shifting from the dominant orientation towards training specialists for the state sector of the economy and large enterprises, but also to prepare ones for scientific-technological and innovative entrepreneurship. It is necessary to introduce pre-incubation and business acceleration programs, as well as more fully support the creation of small technological firms based on research groups of universities [1; 2]. It should be noted, that entrepreneurial training should be oriented also to solve a problem of internal brain waste effect of the university graduates, who have no possibility to work in accordance to gained competences in Ukraine.

Some steps should be taken to ensure that highly skilled emigrants do not lose their scientific and technological links with their colleagues in Ukraine, and this work is to some extent conducted in research institutions and universities, although it lacks targeted state support.

However, for the thorough, skilled and systematic answers to the challenges we have in the country, there is still a lack of scientific and organizational competence, motivated interest and resources.

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## ЄВРОПЕЙСЬКІ ВИКЛИКИ ДЛЯ УКРАЇНСЬКОЇ ІННОВАЦІЙНОЇ ПОЛІТИКИ І ТЕХНІЧНИХ УНІВЕРСИТЕТІВ

*У статті розглядаються проблеми, що стосуються якості досліджень для інновацій, їх суспільного впливу, «відпливу інтелекту» та формування підприємницьких екосистем. Ці проблеми вже існують в Україні, однак можуть загострюватись на шляху її інтеграції до європейських структур, якщо інноваційна політика не зміниться. Розглянуто показники досліджень, розробок та інноваційної діяльності в Україні, проаналізовано досвід ряду країн Євросоюзу. Розглянуто рекомендації комісії експертів програми «Горизонт 2020» (2016 р.), пропозиції Європейської ліги дослідницьких університетів (2017 р.).*

*Доведено, що зазначені проблеми у процесі євроінтеграційного руху країни загострюються і можуть розглядатись як виклики для національної інноваційної системи та для окремих університетів. Однак зазначено, що Україна може скористатись наявним позитивним досвідом європейських країн щодо подолання схожих проблем. При цьому нова політика і менеджмент повинні будуть протидіяти сформованим підходам, необхідно також вносити зміни в законодавство.*

*Для подолання зазначених викликів запропоновано здійснити заходи державної політики та менеджменту, що були запропоновані у попередніх роботах автора, зокрема проводити атестацію вчених за досвідом Великої Британії, але у дещо спрощеному вигляді, а також запровадити систему фінансування досліджень на основі оцінювання їх результативності.*

***Ключові слова:*** *інновація, виклик, дослідження та розробки, досконалість досліджень, суспільний вплив, відплив інтелекту, підприємницька екосистема.*

### Summary

***Introduction.*** *Ukraine has low indicators in the field of science, technology and innovation, the emigration of scientists continues. At the same time, the people and the authorities of the country are eager to go through the path of European integration. Will the challenges to Ukraine's economic and socio-humanitarian development be exacerbated on this path, if we proceed from the experience of European developing countries?*

***Formulation of the problem.*** *Among the unresolved issues of the functioning of the national innovation system, according to domestic and foreign experts, the problem of the research excellence for innovation, «brain drain» and the development of innovative entrepreneurship, in particular the so-called entrepreneurial ecosystems, occupy an important place. Our research focuses on whether these issues are aggravated under the conditions of the European integration movement of Ukraine and how to reform the innovation policy and management at the country level and at universities.*

***The purpose of the study*** *is to determine the essence of the challenges of the research quality for innovation and societal impact, «brain drain», the development of entrepreneurial ecosystems that arise before the national innovation system and technical universities in the process of moving towards the European integration of Ukraine in order to identify the basics for improving innovation policy.*

***The main material*** *of the article includes consideration of the indicators of research, development and innovation activities in Ukraine, the analysis of the experience of a number of EU countries. The recommendations of the Horizon 2020 Policy Support Facility Panel (2016) and the proposals of the European League of Research Universities (2017) are considered.*

***Results and discussion.*** *It is proved that the problems of societal impact and research excellence for innovations, the drain and circulation of «brains», the development of entrepreneurial ecosystems in the process of the European integration movement are exacerbated and can be considered as challenges for the national innovation system and for individual universities. However, it is noted that Ukraine can use the existing positive experience of European countries to overcome similar problems. At the same time, new policies and management will have to counteract the existing approaches, it is also necessary to make change in the legislation.*

***Conclusions and recommendations.*** *In order to overcome these challenges, it was proposed to implement public policy and management measures that were proposed in the author's previous work, in particular to carry out assessment of scientists according to the UK experience, but somewhat simplified, and to introduce a performance based funding system.*

***Keywords:*** *innovation, challenge, entrepreneurship, research & development, research excellence, societal impact, brain drain, entrepreneurial ecosystem.*

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