# CURRENT TRENDS OF INNOVATION DEVELOPMENT IN THE EDUCATIONAL ACTIVITY OF UKRAINE UNDER CONDITIONS OF THE DIGITAL ECONOMY

# СУЧАСНІ ТЕНДЕНЦІЇ РОЗВИТКУ ІННОВАЦІЙ В ОСВІТНІЙ ДІЯЛЬНОСТІ УКРАЇНИ В УМОВАХ ЦИФРОВОЇ ЕКОНОМІКИ

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**Gryshchenko Ivan**
Doctor of Economics, Professor,
Academician of the National Academy
of Pedagogical Sciences of Ukraine
Kyiv National University
of Technologies and Design
**Belyalov Talat**
Candidate of Economic Sciences,
Associate Professor
Kyiv National University
of Technologies and Design

*This article it is substantiated that the negative tendency to reduce the number of higher education institutions in Ukraine, necessitates the search for new tools for the development of domestic higher education. It is proved that the development of innovative technologies in the modern conditions of society formation and functioning is directly related to the formation of a new type of economic relations, which is called the digital economy. The main provisions of the digital economy are analyzed and the directions in which the digitization of the economy should take place are determined. It is substantiated that business universities are given new roles as a center for the formation of business skills, and the Center for Innovative Technologies acts as an innovation system that provides other organizations with information consulting, science and technology, infrastructure and production services to solve technology transfer and commercialization of subjects of innovation activity.*
**Key words:** *innovation activity, innovation activity of higher education institutions, digital economy, educational activities, university, technologies transfer, academic entrepreneurship.*

*В статье обосновано, что негативная тенденция к уменьшению количества высших учебных заведений в Украине, вызывает необходимость поиска новых инструментов развития отечественной высшей школы. Доказано, что развитие инновационных технологий в современных условиях формирования и функционирования общества напрямую связан с формированием нового типа экономических отношений, который получил название цифровой экономики. Проанализированы основные положения цифровой экономики и определены направления, по которым должно происходить цифровизация экономики. Обосновано, что предпринимательским университетам добавляются новые роли организации формирования навыков ведения предпринимательской деятельности, а Центр инновационных технологий выступает как инновационная система, которая предоставляет другим организациям информационно-консалтинговые, научно-технологические, инфраструктурные и производственные сервисы по решению задач трансфера технологий и коммерциализации объектов инновационной деятельности.*
**Ключевые слова:** *инновационная деятельность, инновационная деятельность высших учебных заведений, цифровая экономика, образовательная деятельность, университет, трансфер технологий, академическое предпринимательство.*

*В статті обґрунтовано, що негативна тенденція до зменшення кількості закладів вищої освіти в Україні, викликає необхідність пошуку нових інструментів розвитку вітчизняної вищої школи. Доведено, що розвиток інноваційних технологій в сучасних умовах формування та функціонування суспільства напряму пов'язаний з формуванням нового типу економічних відносин, який отримав назву цифрової економіки. Проаналізовано основні положення цифрової економіки та визначено напрями, за якими має відбуватися цифровізація економіки. Обґрунтовано, що підприємницьким університетам додаються нові ролі осередку формування навичок ведення підприємницької діяльності, а Центр інноваційних технологій виступає як інноваційна система, котра надає іншим організаціям інформаційно-консалтингові, науково-технологічні, інфраструктурні та виробничі сервіси з вирішення задач трансферу технологій і комерціалізації об'єктів інноваційної діяльності. Проаналізовано діяльність закладів вищої освіти України з питань трансферу технологій та академічного підприємництва, що дозволило визначити основні напрями результатів науково-дослідної роботи університетів у вигляді новоствореної вдосконаленої конкурентоспроможної технології, продукції або послуги, що істотно покращує структуру та якість виробництва. Проведене дослідження довело, що поєднання освітянської діяльності з інноваційним розвитком здатне надати нового поштовху до розбудови нових принципів функціонування національної моделі економічної системи в умовах цифрової економіки.*
**Ключові слова:** *інноваційна діяльність, інноваційна діяльність закладів вищої освіти, цифрова економіка, освітня діяльність, університет, трансфер технологій, академічне підприємництво.*

**Formulation of the problem.** The modern educational environment is characterized by the development of various forms of international cooperation and the modernization of the main activities of modern universities. The successful integration of universities into the world educational space highlights the need, on the one hand, to significantly intensify and expand the scope of international activities in all vectors; and on the other hand, the expansion of their economic and entrepreneurial functions to strengthen them as independent powerful institutions in the global market of educational services.

The development of innovative technologies in the modern conditions of formation and functioning of society is directly related to the formation of a new type of economic relations, which is called the digital economy. The combination of educational activities with innovation development can provide a new impetus to the development of new principles of functioning of the national model of the economic system. That is why the study of trends in innovation of domestic higher education institutions is especially relevant in the digital economy.

**The aim of the article** is to study the features of innovation development of domestic universities through the prism of the formation and development of the digital economy and the formation of modern trends in education to build a basis that will promote entrepreneurial skills and innovation.

**Analysis of recent publications and the unresolved part of the problem.** Among the most famous scientists who have made a significant

contribution to the study of innovative processes in education and management of their implementation should be distinguished such researchers as V. Andrushchenko, L. Vashchenko, L. Danylenko, S. Klepko, V. Korzhenko, V. Kremen, S. Nikolaenko, V. Palamarchuk, S. Khatkevych and others. The main trends and principles of the digital economy as a new stage of development of post-industrial society have been studied by many foreign and domestic scientists, including W. Isaacson, J. von Neumann, B. Heitz, N. Norets, N. Kraus, O. Kryvoruchko, V. Kupriyanovsky, O. Dannikov, Kolyadenko and others. However, the issues of development of innovation activity of higher education institutions in the conditions of the digital economy remain little studied.

Presentation of the main results and their substantiation. Tendencies of the development of the global educational environment clearly demonstrate the dynamic transformation of higher education institutions and the changing orientations of the functioning of universities in the direction of multi-vector activities.

During the last decade, in particular during 2014–2015, there was a significant decline in the number of higher education institutions, which was caused by the annexation of the Crimean Peninsula and Russia's armed aggression in eastern Ukraine. In the following years, the figure showed slight fluctuations, as for 2019 in Ukraine there are 281 institutions of higher education, which enroll 1266 thousand students. Data on the dynamics of the number of domestic higher education institutions during 1991–2019 is shown in Pic. 1, which demonstrates a gradual movement towards a decrease in the number of education institutions during the study period [1].

According to the State Statistics Service of Ukraine [2], since 2008, Ukraine has been gradually reducing the number of students, graduate students and doctoral students. Thus, at the beginning of 1990–1991, 881300 applicants for higher education studied in Ukrainian free educational institutions (universities, academies, institutes). This figure reached its peak in 2007–2008 academic year – 2372500 people, after which it began to gradually decrease.

The decrease in the number of higher education seekers is caused by the same factors that led to a decrease in the number of higher education institutions: the demographic and economic crisis, the annexation of Crimea and the military aggression of the Russian Federation in eastern Ukraine.

The analysis of the data contained in Picture 2 shows that the number of students per university during the period under review has repeatedly changed its development trends. Thus, from 1990/91 the figure gradually decreased until 1996/97, reaching an absolute minimum of 3,565 students. The next stage was ascending, and it continued until the 2007/08 school year, when an absolute maximum of 6,759 people was reached. After that, the trend of the indicator changed again, and the declining stage began, as a result of which this indicator is constantly decreasing.

Thus, it can be argued that there is a negative trend to reduce the number of higher education institutions in Ukraine, which necessitates the search for new tools for the development of domestic higher education.

The development of innovative technologies in the modern conditions of formation and functioning of society is directly related to the formation of a

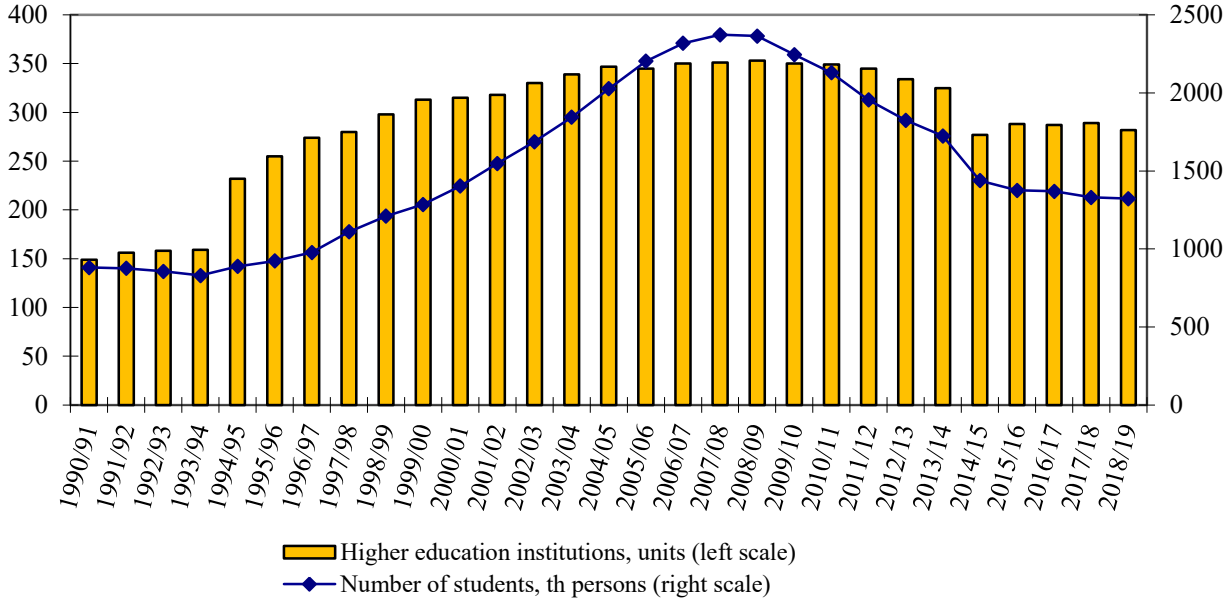


**Figure 2. Dynamics of relative indicators of students per one higher education institution and 100,000 population in 1991–2019**

*Source: calculated according to [1]*

new type of economic relations, which is called the digital economy. The combination of educational activities with innovation development can give a new impetus to the development of new principles of functioning of the national model of the economic system in the digital economy. Therefore, it is expedient to study the peculiarities of the functioning of the University of Entrepreneurship as a center of innovative technologies through the prism of the formation and development of the digital economy and the formation of modern trends in education to build a base that will promote entrepreneurial skills and innovation.

Thus, from the technological point of view of the organization of business processes, the digital economy is characterized by the following provisions:

– digitization and simplified transfer of information, which significantly reduces the time and cost of creating, analyzing, systematizing, processing and storing information, simplify and optimize the management decision-making process;

– improvement of the business communication system due to the construction of large networks used to simplify business processes, create databases and virtual markets;

– creation of sharing economy networks, which allows to expand access to economic benefits of shared use and reduce average costs;

– personalization of sellers and buyers, the ability to create a private office, which allows you to actively apply various modern marketing methods, optimize marketing costs and significantly improve the process of forming focus groups;

– creation of direct connections, which involves reducing the cost of finding contractors and forming a system of direct sales without the use of intermediaries. In addition, digitization is a fairly simple process that significantly reduces barriers to market entry and direct sales networks.

The study of the phenomenon of the digital economy from the standpoint of economic theory, rather than changes in technological processes, is its clear conceptual definition from the standpoint of economy and its further integration into the currently recognized system of basic economic knowledge.

Let us consider the main markers of the formation of the digital economy as a set of technological changes in various areas of socio-economic development and their implementation in Ukraine.

The formation of the digital economy is a rather difficult task, while solving which countries face technical, organizational and cultural problems. Digital technologies are changing the usual business model, becoming a prerequisite for the emergence of new products and innovations. It is important to understand that the digitization of the economy is not an end in itself – it is a way to form an open information society, a tool to achieve the goal.

Own considerations, analysis and generalization of the works of domestic economists [3; 4] allow us to identify areas in which the digitization of the economy should take place:

Firstly, the economic and institutional direction. The process of digitization of the economy requires the transformation of the institutional environment and socio-economic relations in the country, as it is based on new models of business management. The use of digital technologies Blockchain, CRM & BPM and others requires appropriate institutional and regulatory support.

Secondly, the technological direction. Of course, the formation of the digital economy on the old material base is impossible. All actions of technical and technological nature must be certified.

Thirdly, the production direction involves the transformation of production relations, the formation of a new production structure taking into account new models of doing business, management, the use of new technical support.

And last but not least, the socio-cultural direction. Its task is to form in consumers the need to use products that are the result of digitization of the economy in various spheres of life: medicine, education, transport, trade, tourism and others.

The digital economy in case of intensification of its introduction and reforming of methods and principles of business organization and construction of national model of mixed economy under conditions of construction and further development of post-industrial society will develop in the following directions:

1) development of new forms of money and use of Blockchain technology;

2) creation of new financial instruments and development of new forms and subjects of activity in the financial markets;

3) reform of state regulatory policy and transformation of the main targets of monetary policy;

4) conducting quasi-fiscal operations;

5) development of FinTech technologies in the digital economy;

6) development of the identification system;

7) the interaction of financial and real sectors of the economy during the formation of a new export model of state development.

The peculiarities of the world economy emphasize the fact that in most countries of the world it has passed to the post-industrial stage, when the first place goes to a person endowed with creative, intellectual potential and able to create new knowledge. The process of integration of science and technology is characterized by the priority of development of science and new technology.

Innovation development of domestic enterprises involves the systematic implementation of scientific achievements in the real sector of the economy, as well as the intensification of innovation activities of

organizations and business structures. The most important role in this process should be played by the innovation activity of higher education institutions.

Nowadays, Ukraine has a strong scientific and technological potential, consisting of 281 institutions of higher education, about 1.2 million students, about 75,000 teachers with degrees, about 54,000 associate professors and professors, 999 research institutes, the National Academy of Sciences of Ukraine with 178 institutes and 19,000 researchers, several other national academies of sciences; decades of tradition of world-renowned research [5].

The ultimate goal of the state's innovation policy is to bring to market new competitive goods and services that will provide technological leadership and a better and safer standard of living for the country's citizens.

However, there is a gap between the emergence of an idea and its implementation in enterprises between research and the subsequent investment of private capital in research results.

The most effective mechanism for overcoming this is the creation of innovative products and the participation of research groups in European programs, in particular in the Horizon 2020 Framework Program and the new EU HORIZON EUROPE program, which will operate in 2021–2027 [6]. These programs have great emphasis on regional strategies for Smart Specialization, the development of digital innovation hubs (DIHs) and the combination of European investment funds from the EU Structural Funds with national research and investment programs.

Universities play a major role as centers of high-level education and advanced research, and business universities are given new roles as a center for business skills, business consulting, project generation involving local business and government, a pub-

Table 1

**Activities of the Higher Education Institutions of Ukraine on technology transfer and academic entrepreneurship**

| Indicator | Indicator value |
|---|---|
| Number of studied HEI | 147 |
| Number of HEI involved in technology transfer and academic entrepreneurship | 118 |
| Number of HEI that carry out technology transfer activities, but do not have the appropriate structural unit | 10 |
| Structural units responsible for participation in technology transfer:<br>– research units<br>– sectors<br>– technology transfer centers<br>– separate departments<br>– research institutes<br>– laboratories<br>– science park | <br>25<br>9<br>14<br>56<br>4<br>2<br>1 |
| The average number of structural units, which are responsible for the transfer of technology, persons | 4 |
| Number of HEI that do not have the appropriate structural unit, the competencies of which include issues of academic entrepreneurship | 50 |
| Structural subdivisions answering questions of academic entrepreneurship:<br>– research units<br>– sectors<br>– centers<br>– groups<br>– research institutes<br>– business incubators<br>– science parks | <br>18<br>1<br>11<br>1<br>1<br>5<br>6 |
| The average number of structural units, the competence of which includes issues of academic entrepreneurship, persons | 6 |
| Received patents by higher education institutions for the period 2015-2018, units | 12374 |
| Licensing agreements were concluded by higher education institutions for the period 2015-2018, units | 506 |
| Number of HEI that use the capabilities of national and international technology transfer networks:<br>– National Technology Transfer Network (NTTN)<br>– Ukrainian integrated system<br>– Automatized system of formation of integrated interstate information resources | 40<br>28<br>4<br>3 |
| Number of HEI that were founders or co-founders of business associations | 21 |
| Number of HEI that took part in the creation of science parks | 18 |
| Number of HEI cooperating with small and medium enterprises | 76 |
| Number of HEI cooperating with large enterprises | 66 |
| Number of HEI that have their own developments | 80 |
| Total number of own developments that HEI have | 4443 |

*Source: made by the authors on the basis of [7]*

lic communications center for innovation networks and communities. The Center for Innovative Technologies acts as an innovation system that, in addition to developing its own innovative projects and innovation infrastructure, provides other organizations with information consulting, scientific-technological, infrastructural and production services to solve problems of technology transfer and commercialization of innovation objects.

Analysis of the activities of higher education institutions of Ukraine on technology transfer and academic entrepreneurship allowed to obtain the following results (Table 1).

Thus, based on the analysis, it can be concluded that out of 277 higher education institutions in Ukraine, only 118 have technology transfer activities and academic enterpreneurship; only 76 universities cooperate with small and medium-sized businesses, and 60 cooperate with large businesses. Quantitative ratio of cooperation of higher education institutions with small and medium and large businesses (by areas of activity of such enterprises according to the NACE) is presented in Table 2.

Thus, Table 2 shows that the largest number of enterprises with which the Higher education institutions of Ukraine cooperate operate in the field of professional, scientific and technical activities, construction and processing industry.

It should be noted that domestic higher education institutions have significant scientific and scientific-technical achievements. As a result of the analysis of 240 innovation developments of the leading higher education institutions of Ukraine, it was determined that the main directions of results of research work of higher education institutions in the form of newly created improved competitive technology, products or services that significantly improve the structure and quality of production are as follows:

– agro industrial complex and biotechnology;
– scientific support of security and defense;

Table 2

**Quantitative ratio of cooperation of higher education institutions with small and medium and large businesses by areas of activity of such enterprises according to the NACE**

| Section | Name | Small and medium business | | Large business | | Have their own developments | |
|---|---|---|---|---|---|---|---|
| | | Number | Specific weight, % | Number | Specific weight, % | Number | Specific weight, % |
| A | Agriculture, forestry and fisheries | 29 | 8,1 | 16 | 7,4 | 35 | 8,1 |
| B | Mining and quarrying | 7 | 1,9 | 9 | 4,2 | 13 | 3,0 |
| C | Process manufacturing | 34 | 9,4 | 28 | 13,0 | 41 | 9,5 |
| D | Supply of electricity, gas, steam and air conditioning | 21 | 5,8 | 11 | 5,1 | 28 | 6,5 |
| E | Water supply; sewerage, waste management | 23 | 6,4 | 14 | 6,5 | 31 | 7,2 |
| F | Construction | 23 | 6,4 | 19 | 8,8 | 23 | 5,3 |
| G | Wholesale and retail trade; repair of motor vehicles and motorcycles | 7 | 1,9 | 3 | 1,4 | 8 | 1,9 |
| H | Transport, warehousing, postal and courier activities | 15 | 4,2 | 10 | 4,6 | 31 | 7,2 |
| I | Temporary accommodation and catering | 4 | 1,1 | 1 | 0,5 | 4 | 0,9 |
| J | Information and telecommunications | 31 | 8,6 | 1 | 0,5 | 35 | 8,1 |
| K | Financial and insurance activities | 17 | 4,7 | 7 | 3,2 | 15 | 3,5 |
| L | Real estate transactions | - | | - | | 1 | 0,2 |
| M | Professional, scientific and technical activities | 37 | 10,3 | 27 | 12,5 | 47 | 10,9 |
| N | Activities in the field of administrative and support services | 8 | 2,2 | 8 | 3,7 | 8 | 1,9 |
| O | Public administration and defense; compulsory social insurance | 5 | 1,4 | 10 | 4,6 | 13 | 3,0 |
| P | Education | 36 | 10,0 | 26 | 12,0 | 44 | 10,2 |
| Q | Health care and social assistance | 14 | 3,9 | 13 | 6,0 | 22 | 5,1 |
| R | Arts, sports, entertainment and recreation | 2 | 0,6 | 4 | 1,9 | 7 | 1,6 |
| S | Provision of other types of services | 22 | 6,1 | 9 | 4,2 | 24 | 5,6 |
| T | Activities of households | 2 | 0,6 | - | - | 1 | 0,2 |
| U | Activities of extraterritorial organizations and bodies | 23 | 6,4 | - | - | - | - |

*Source: made by the authors on the basis of [7]*

– information and communication technologies;
– new materials and nanotechnologies;
– energy and energy efficiency;
– mechanical engineering;
– instrument making;
– construction technologies and vehicles;
– health care;
– rational use of nature.

Thus, a significant stimulus for the development of academic entrepreneurship is the emergence of new economies, in particular, such as the knowledge economy, digital economy, sharing economy, digital education and science, and others. Ukraine, which is located in the heart of Europe by its territorial location, is not just stimulating, but obliges to take a leading place in the center of European entrepreneurial culture. And this is possible thanks to academic entrepreneurship as a means of realizing university potential in the regional and global dimensions. Changing our usual model of university professional activity and realizing that universities are full-fledged and significant elements of the market structure will allow Ukraine to join the global competition in science.

**Conclusions and prospects for further research.** Problems of development of the global educational environment and transformation of role and functions of its main subjects – universities – are objects of the increased scientific interest both in the direction of research of questions of financial and logistical support, and of a vector of identification of priorities of increase of their competitiveness, improvement of the basic kinds of university activities, strengthening innovation activity, etc. That is why the development of innovative technologies in the modern conditions of formation and functioning of post-industrial society is directly connected with the formation of a new type of economic relations, which is called the digital economy. The combination of educational activities with innovation development can give a new impetus to the development of new principles of functioning of the national model of the economic system in the digital economy. Therefore, further study of the functioning of the University of Entrepreneurship as a center of innovative technologies should be carried out through the prism of the formation and development of the digital economy and the formation of modern trends in education to build a basis that will promote entrepreneurial skills and innovation.

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