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Innovative infrastructure of higher education as a factor of the development of the economy of Ukraine

ІННОВАЦІЙНА ІНФРАСТРУКТУРА ВИЩОЇ ОСВІТИ ЯК ЧИННИК РОЗВИТКУ ЕКОНОМІКИ УКРАЇНИ

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Abstract

The purpose of the article is to determine the possibilities of the innovative infrastructure of higher education of Ukraine to influence the development of the state's economy. The results of the conducted research are based on a critical analysis of the problems that stand in the way of the formation and further development of innovative infrastructure of national higher education. During the research, it was identified that now Ukraine has created a regulatory framework that will ensure this development, but in practice, a few higher education institutions have an innovative infrastructure. An analysis of the main forms of innovative infrastructures operating in Europe and the United States was conducted to determine the most favourable conditions and opportunities for their implementation in Ukraine. In particular, technology parks, business incubators, and

Анотація

Метою статті є визначення можливостей впливу інноваційної інфраструктури вищої освіти України на розвиток економіки держави. Результати проведеного дослідження ґрунтуються на критичному аналізі проблем, що стоять на заваді формуванню та подальшому розвитку інноваційної інфраструктури національної вищої освіти. У ході дослідження з'ясовано, що наразі в Україні створене нормативно-правове поле, здатне забезпечувати цей розвиток, однак на практиці лише деякі заклади вищої освіти мають інноваційну інфраструктуру. З метою визначення найбільш сприятливих умов для розвитку інноваційної інфраструктури вищої освіти та можливостей їх реалізації в Україні був проведений аналіз основних форм інноваційних інфраструктур, що функціонують у просторі Європи та США. Зокрема, було

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clusters were considered. The most successful forms of innovative infrastructure in the world were identified, in particular, Silicon Valley and Plastic Valley. Based on the results of the research, recommendations were developed for the development of innovations commercialisation centres in higher education institutions. The practical value of the obtained results lies in identifying the main ways of establishing and developing of the innovative infrastructure of higher education in Ukraine, which can provide an opportunity to increasing the level of efficiency of the Ukrainian economy and bringing the level of educational services to the level of compliance with international standards.

Keywords: European integration, clusters, innovative infrastructure, system of higher education, higher education institutions.

Introduction

Ukraine's transition to a market economy led to the formation of a goods and services market and a labor market in our country. The labor market regulates the social demand for specialists in various fields and balances the demand for specialists in certain professions with the available offer of applicants for positions.

The modern labor market is very competitive, makes strict requirements for job applicants and has high selection criteria.

Higher education is designed to ensure that employees meet these criteria. Therefore, today it has become a source of human capital development, the basis of the formation of social, cultural and economic potentials of society, a center of integrative educational and creative activity, which combines innovations in all spheres of social development into a new productive integrity.

The focus of higher education on the introduction of innovations in the content of training and scientific activity of students has become a guarantee of ensuring the quality of university education. In addition, it actualized the recognition of universities as an important component of the National Innovation System, which is responsible for training innovative workers and managers capable of implementing, producing, transferring of innovations and commercializing the results of innovative activities.

розглянуто технопарки, бізнес-інкубатори та кластери. Схарактеризовано найбільш успішні форми інноваційної інфраструктури у світі, зокрема, Кремнієву долину та Пластикову долину. За результатами проведеного дослідження було розроблено рекомендації щодо розвитку центрів комерціалізації інновацій у закладах вищої освіти. Практична цінність отриманих результатів полягає у виокремленні основних шляхів становлення та розвитку інноваційної інфраструктури вищої освіти в Україні, що сприятиме підвищенню ефективності української економіки та наближенню рівня надання освітніх послуг до міжнародних стандартів.

Ключові слова: євроінтеграція, кластери, інноваційна інфраструктура, система вищої освіти, заклади вищої освіти.

To fulfill this function, universities should become subjects of the formation and development of innovative infrastructure.

One of the steps on this path is digital transformation, which concerns all the most promising areas of the economy and is a priority area for ensuring the competitiveness of the state in the modern globalised world. According to M. Kopp et al., (2019), the key condition of the digitalisation course is the establishment of internal demand for technologies and their corresponding consumption by economic sectors and the population, and the elimination by the state of various barriers of institutional, economic, legislative nature that hinder the development of an innovative economy. As the study by S. Montazer et al., (2020) notes, the ability of technologies to influence the efficiency and productivity of the business and the economy convincingly allows concluding that it is appropriate to take a number of measures that will provide an opportunity to initiate and stimulate large-scale transformation projects, including within the framework of public-private partnerships. Notably, the modernisation of many fields of public life, such as medicine, education, transport, public security, ecology based on the principles of electronic management allows creating of a new system for citizens to implement the competencies of the digital plan and human capital to adapt to rapid changes in technology, the labour market, and the economy.

Educational activities in the context of digitalisation and globalisation are undergoing

drastic changes. They are related to the development of technology, new competencies and professional requirements in the labour market, and an increase in the growth rate of knowledge. In accordance with this, the modern education system requires new approaches to the organisation and creation of innovative forms, due to which it is possible to transfer and assimilate the acquired competencies and knowledge. As N.G. Ugur (2020) notes, the accelerated development of digital technologies provides an incentive to further introduce innovative forms of education that can keep up with changes.

Thus, the purpose of the study is to establish the possibility of forming an innovative infrastructure in higher education institutions in Ukraine. According to this, it is necessary to analyse the latest trends in the introduction of innovative infrastructure in the educational system, identify the main problems and ways to overcome them.

Literature Review

According to the results of the World Economic Forum Annual Meeting (World Economic Forum, 2020) analysis, which was held in 2020, the top 10 competencies that will be most in demand in the future were identified. These include emotional intelligence, creativity, critical thinking, complex problem solving, cognitive flexibility, service orientation, making judgments and decisions, coordinating actions with others, interacting and negotiating, and coordinating actions with others.

In accordance with the opinion of O. Ahel and K. Lingenau (2020), the Bologna Process is aimed at harmonising and accelerating the improvement of educational systems in European countries, while simultaneously unifying and converging them. In this regard, it is necessary to highlight the main features, namely the transformation of the European education system into a competitive and attractive space, lifelong continuing education, mobility of the educational services market, a system of comparable academic degrees and credits, and a simplified procedure for recognising educational qualifications. The current educational situation in Ukraine in comparison with European countries is characterised by a number of problems. According to position L. Kharitonenko (2022), these are the insufficient cooperation of higher education institutions (HEI) with the modern labour market, low level of student mobility, reduced methodological equipment of

teachers, and a gradual deterioration in the quality of educational services. Notably, the development of innovative infrastructure is the key to the full functioning of an effective economic system. This determines the relevance and expediency of the analysis of the interaction of higher education and the labour market in the context of European integration of Ukraine.

Methodology

The study was performed using various analysis methods. In particular, the method of logical analysis was aimed at identifying the main problems that hinder the establishment and development of innovative infrastructure in higher education institutions in Ukraine. The functional analysis method provided an opportunity to identify the main advantages and disadvantages of each of the forms of innovation commercialisation centres, namely technology parks, clusters, and business incubators. The formal legal method was used to analyse the normative legal doctrine of Ukraine and a number of other documents. Thus, the provisions of the following documents were investigated: the Law of Ukraine No. 991-XIV "On Special Regime of Innovation Activity of Technological Parks" (1999), Magna Charta Universitatum (1988), Convention on the Recognition of Qualifications concerning Higher Education in the European Region (Council of Europe, 1997), Sorbonne Declaration (National Aviation University, 1998), The Framework for Qualifications of the European Higher Education Area (Ministry of Science Technology and Innovation, 2005), Joint Declaration of the Ministers of Education of Europe "European space in the field of higher education" (Verkhovna Rada of Ukraine, 1999), Law of Ukraine No. 1556-VII "On Higher Education" (2014) and Association Agreement between Ukraine, on the one hand, and the European Union, the European Atomic Energy Community and their member states, on the other hand (Verkhovna Rada of Ukraine, 2014). The method of legal hermeneutics was also used to conduct a detailed analysis of the provisions of the legal doctrine. Its value was the identification of gaps in Ukrainian legislation and ways to improve the quality of the educational process.

The analysis of the main forms operating in Europe and the United States was conducted to determine the most favourable conditions and opportunities for the dissemination of innovation infrastructure in higher education institutions of Ukraine, using the method of comparative analysis, which allowed determining the

effectiveness of such clusters and technology parks as Silicon Valley and Plastic Valley. Regarding this aspect, the method of abstraction was also used, which provided an opportunity to highlight the essential features, signs, and features of the functioning of foreign centres for the commercialisation of innovations, which will help to determine the prospects for implementing a similar mechanism in Ukraine. Due to the use of the deduction method, the current state of the innovative infrastructure of higher education institutions was characterised based on practical activities. The induction method, in turn, allowed for determining the prospects and possibility of the establishment and development of innovative infrastructure through the analysis of resources and the scientific-technical foundation of institutions of higher education in Ukraine. In particular, the synthesis method helped to determine the range of recommendations for improving the level of efficiency of this segment, considering certain aspects of the theoretical and practical area.

Notably, this study was conducted to cover all the fundamental principles of implementing the mechanism of innovation infrastructure in Ukraine. Thus, the aspect of highlighting the current state of innovation processes in the higher education system in Ukraine and their resource support was of particular importance. Based on this, the range of problems that hinder the development of innovative infrastructure of Ukrainian universities was identified. In accordance with this, the analysis of the most promising and favourable forms of commercialisation of innovations in higher education institutions was conducted and ways of their further development were proposed.

Results and Discussion

The establishment and development of the Ukrainian economy, which will be characterised by a high level of competitiveness and based on innovation, is possible only if the full-fledged infrastructure of higher education institutions operates. It should include innovation centres, technological and scientific parks, investment and venture funds, technology transfer centres, etc. Such structures are endowed with the ability to ensure the integration of education, science, and production in the most favourable and efficient way, and promote the rapid implementation of scientific findings and advanced discoveries. Notably, the integration of science with entrepreneurial activity ensures the passage of a certain cycle, namely: the emergence of an idea, the development of a

prototype, its patenting and further implementation. Referring to the experience of such developed countries as the United States, Great Britain, Germany, France, etc., it can be concluded that the creation of most of the innovative structures was conducted by institutions of higher education of a research type (Miranda et al., 2021). The peculiarity of these educational institutions is that in addition to training highly qualified personnel, the activities of institutes and universities also include conducting studies and developing innovative products. However, the experience of Ukraine in this area is not perfect. This is due to the practical lack of commercialisation of technologies and knowledge. In accordance with this, there is a need to form and further develop the link of the innovative structure in higher education institutions. The creation of scientific-educational complexes and centres, research laboratories, departments, and technology parks will play an outstanding role to solve these issues.

Notably, such centres are independent systems of an innovative type. This provides an opportunity to develop innovative activities and commercialise their results within the institution of higher education, integrating science, production, education, and business into a single innovation complex. The post-industrial economy, which is based on knowledge, sets three main tasks for an educational institution, namely, training personnel, researching, and commercialising the results obtained. One of the forms of interaction between entrepreneurship and science is a business incubator. It is structured as a multifunctional type complex, which aims to provide the most favourable conditions for the implementation of effective activities of newly formed innovative forms that will produce new ideas. A business incubator is a commercial organisation that can provide specially equipped premises for new small and medium-sized businesses on preferential terms for a limited amount of time. Among its functions, the administrative and technical services, consulting and business planning, conducting seminars and trainings are notable. The purpose of the business incubator is to help small and medium-sized businesses, promote the level of competitiveness of companies, establish and develop the infrastructure, create new jobs, and provide bases for practical training of HEI students in production (Benavides et al., 2020). Thus, the creation of a business incubator based on a higher educational institution is not only the development of commercialisation of scientific inventions but also the prospect of creating new

jobs and bases for practice. In addition, the advantage of this organisational form is the provision of all the necessary conditions for the implementation of scientific ideas into reality.

Another form of innovation infrastructure that may include a higher education institution is a cluster – a territorial branch association of business structures on a voluntary basis with scientific institutions and educational organisations. Its goal is to promote the economic development of the region, increase the level of competitiveness of its own products, and attract students of higher education institutions to real practical activities, which substantially increases the level of their professional training. There are several types of clusters that are distinguished by features of innovation. The first type is one that is built on knowledge and belongs to enterprises characterised by a high level of intensity of development and research. Usually, such clusters are formed around leading scientific institutions, among which the chemical, pharmaceutical, and aircraft industries are most often chosen. The second type of cluster is vendor-dependent. In other words, their innovation activity depends on the ability to implement cooperation with developers of innovative technologies; they are usually identified in the field of agriculture and forestry. The third type of cluster is those that are built on information. They operate complex systems to provide specialised services to clients; publishing, finance, and tourism are more common areas for such businesses. There is also such a cluster that specialises in provision. Their specific feature lies in the fact that much attention is paid to relationships with consumers. They are characterised by the production of specific goods. There is another type of cluster, namely the one that is built for the purpose of creating innovative technologies. It is most often identified in the field of instrument engineering and mechanical engineering (Den Hertog & Bilderbeek, 2019).

Clusters play an important role in organising research-type work for both teaching staff and students. Notably, due to the implementation of clusters in higher education institutions, teachers have the opportunity to improve their competence and qualifications, apply new interdisciplinary theories and concepts, and gain experience in modern scientific laboratories. As for students, clusters provide them with the opportunity to gain practical experience in laboratories, work in a team, together with mentors and teachers and, accordingly, learn from invaluable research experience, develop

scientific thinking and communication skills. Equally important, clusters help to commercialise scientific achievements, and thus their development will contribute not only to increasing university funding and gaining experience for researchers but also to developing the economy of the country. One of the most well-known and powerful clusters internationally is Silicon Valley, located in California (Audretsch, 2021). Its scale covers thousands of high-tech companies, whose activities are concentrated in computer activities, software, biotechnology, etc. Well-known companies such as Hewlett-Packard, Kodak, General Electric, Lockheed, and Shockley Transistor operate in Silicon Valley (Gray & Suri, 2019). In Europe, the most famous cluster is the Plastic Valley, located in eastern France near the border with Switzerland (Runiewicz-Wardyn, 2019). In general, its activities are focused on the design of products, plastic cases, processing polymers into finished products, etc. The creation of such clusters and the establishment of innovation clusters in institutions of higher education provides an opportunity to both develop scientific activities and contribute to improving the economic development of the state.

When analysing technology parks – the third form of innovation infrastructure of universities – this is a scientific-technical type complex, which covers higher education institutions, commercial firms, scientific institutions, consulting and information services and operates on the principles of commercialisation of scientific-technical activities (Rahmadoni et al., 2022). This is one of the most common forms of interaction between venture firms and developers in the United States and Western Europe, which provides an opportunity to implement the high-tech products of new generations quickly and efficiently. An example of this is Silicon Valley created based on Stanford University in California (Samosir et al., 2020). This scientific-technological park unites about 3 thousand small and medium-sized firms with a total of 200 thousand people; Silicon Valley employs qualified specialists in the field of information technology from all over the world, including Ukraine. Notably, this organisational form is the most favourable, which is confirmed by the experience of other countries. Thus, this form of combining business entities with higher education institutions will contribute to creating the necessary conditions for the implementation of scientific-technical activities, the commercialisation of inventions, and ultimately, the development of the state economy.

In general, modern universities need to be reorganised into innovative structures that will commercialise the results of studies and innovative projects. The concept of “innovation-integrated structure” should be understood as a set of business entities that are connected by a network system and are aimed at increasing the level of efficiency of innovation activities of participants by optimising the provision of resources. That is, it can be argued that this type of structure in comparison with others is endowed with a large number of advantages, which is due to the ability to ensure not only sustainable economic development and a corresponding increase in the competitiveness of the economic system but also the national security of the country. This provides an opportunity to improve the quality of professional training of graduates of higher educational institutions. This is due to the convergence of theoretical and practical components: the graduates will implement the acquired knowledge and be included in the production process, in accordance with which they will achieve high professional results and improve the level of competitiveness in modern international labour market conditions.

There are several ways to create technology parks that can be implemented in Ukraine. Primarily, it is the creation by academic employees of higher educational institutions of enterprises that aim to commercialise the results of their own scientific findings. Other small firms can also join them. The second way is to create large industrial associations by the scientific and pedagogical staff of the higher education institution, who left the company to create their own business. Usually, large firms do not create obstacles in this regard, but on the contrary, they will contribute to this since they can join the creation of new promising products. The third way is to create a technology park through the reorganisation of existing enterprises that want to take advantage of the benefits created for such parks under the current legislation and operate based on higher education institutions. A special feature of technoparks is the association of companies that implement their own activities in the most advanced areas, namely, science, technology, and microelectronics. Due to their compact location, most of the organisational, secretarial, and managerial functions are performed by qualified personnel.

In other words, the activities of scientific-technological parks are aimed at promoting the establishment of market relations in the field of education and science, organisational and

financial support for the innovation activity of HEIs, the introduction of new inventions and technologies, creation of competition between the subjects of innovation activity by attracting free financial resources, support for the introduction and development of the know-how and new technologies using licenses and patents, attracting investors on a competitive basis for the implementation of the state scientific-technical programmes, and saturation of the market with new competitive goods. In other words, it provides higher education institutions with the opportunity to commercialise scientific achievements and develop this sector.

Ukraine is endowed with a powerful scientific, educational, scientific-technical potential, and strong research structures created based on universities (for example, National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”, National Technical University “Kharkiv Polytechnic Institute”, and other technical universities). However, data centres in universities are still insufficiently developed, which is confirmed by a number of regulatory legal acts, which regulate the national policy on the development of scientific-technical activities at universities. In particular, these include the Law of Ukraine No. 991-XIV “On Special Regime of Innovation Activity of Technological Parks” (1999). The purpose of these legal documents is to activate the scientific activities of higher educational institutions to train highly qualified specialists. In other words, a special regulatory framework has been formed in Ukraine, which will ensure the sustainable development of commercialisation of scientific achievements in higher education and scientific institutions. However, as practice shows, only a few universities have technology parks.

In accordance with this, there are a number of problems that hinder the development of innovative infrastructure in Ukrainian universities. The first of them is the shortage of personnel in universities. This is due to the fact that such high-tech centres require specialists who will understand both the technical and economic aspects of issues. The second problem is the post-Soviet mentality. Is it quite difficult for Ukrainian researchers to combine business and science, to recognise their authorship of the study, this results in public disclosure of information, which makes patenting impossible in the future. The next problem is insufficient funding of higher education by the state and commercial enterprises, according to which the scientific and technical base of most higher education institutions is outdated. The creation of

subsidiaries is notable. This is due to the inhibition of the complex approval mechanism, namely that it is necessary to obtain the written consent of the ministry to receive a share. For universities in other countries, it is a daily practice to enter into the authorised capital of companies with their own patents and sell them licenses. For example, the British company Imperial Innovations has created more than 60 spin-out companies and attracted 175 million external investments; this has provided an opportunity to create about 550 jobs (Martineau & MacLachlan, 2019). In particular, The Massachusetts Institute of Technology (USA) received the funds under license terms. Their distribution is as follows: 15% – to the invention licensing service, and from the rest – 1/3 – to the university, 1/3 – to the faculty, and 1/3 – to the inventor (MIT Technology Licensing Office, 2023).

The development of real and favourable conditions for creating technology parks, clusters, and business incubators is important to overcome the above-mentioned problems in Ukraine. It is also necessary to attract not only professors and teachers of higher education institutions, but also students, postgraduates, and graduates who will work in the real sector and introduce non-standard innovative ideas. It is important to provide ample opportunities for the appropriate creation and further development of technology parks, business incubators, and clusters based on the enterprise sector and private capital. In other words, to implement an effective educational process, it is necessary to create conditions for cooperation with scientific institutions and enterprises, the main idea of which is the commercialisation of scientific findings.

The Ministry of Education and Science of Ukraine initiated the development of a programme to support Ukrainian startups (Ministry of Education and Science of Ukraine, 2022). This is due to the rapid establishment of a promising area – innovative enterprising. This can happen even at the local level. In the context of decentralisation and digitalisation, this provides opportunities for local authorities to implement strategic long-term planning to create an economy of a new type. Thus, the creation of conditions that will help scientific and technical institutions develop favourably will have a positive impact on the establishment of sustainable economic development in Ukraine. Further research will be aimed at analysing the activities of clusters and technology parks in

Ukrainian universities in accordance with the legislation.

The complexity of developing innovative infrastructure in higher education institutions in Ukraine is due to a problems faced by the higher education sector in the context of its interaction with the labour market. In particular, this is the lack of regulation of the current legislation, the underdevelopment of mechanisms for regulating the socio-economic and regulatory nature of the implementation of these processes, and the insufficient number of highly qualified specialists in the commercialisation of research and innovative development of education. According to this, aspects of the functioning of commercialisation of higher education as one of the areas of innovative development require a more detailed analysis. As noted by P.R. Oeij et al., (2019), this is stated in key European documents, and one of the most important steps in integrating education is the creation of the European Higher Education Area (EHEA). It is worth agreeing with this and adding that the basis of this process is three important regulatory acts, namely Magna Charta Universitatum (1988), Convention on the Recognition of Qualifications concerning Higher Education in the European Region (Council of Europe, 1997), and the Sorbonne Declaration (National Aviation University, 1998). In the above normative documents, the agreement between the states on the main terms and criteria of higher education in Europe is recorded, the main principles of qualification, the powers of state bodies, training periods are defined, mechanisms for recognising higher education qualifications are highlighted, the mechanism for implementing the provisions of conventions in the educational process is described, etc.

One of the most important achievements of the EHEA in the context of the establishment of the legislative framework is the creation of the Framework of qualifications in the European educational space (Zakharchenko, 2017). In accordance with this, compatible and comparative qualifications for higher education systems were developed that describe them considering certain factors, and two main cycles with different profiles and orientations were provided that will meet the needs of teachers, students, and the conditions of the labour market. The key objectives of this regulatory act are to ensure transparency, mobility, and recognition of these principles at the international level. As highlighted by V.J. García-Morales et al., (2021), digital literacy is recognised by the countries of the European Union as one of the 8 important

competencies for a fulfilling life and work. Notably, the development of this area is based on the use of the indicator of digital intelligence, which implies the use of digital technologies in higher education, business, professional activities, everyday life, media, etc. Notably, the development of digital literacy provides an opportunity to implement and develop innovative infrastructure in universities, which, in turn, helps to design the content of practical training for future professionals in higher education institutions.

The Bologna Declaration has had and still has a substantial impact on the educational process in Europe (Verkhovna Rada of Ukraine, 1999). Due to the Declaration, an unprecedented and ambitious process of integration into traditionally diverse national systems has been implemented. Despite the fact that the Bologna Process has made a great contribution to the establishment and development of the higher education platform in many countries, now there is a need to reconsider the main trends and ways. One of these trends is the commercialisation of the innovation process in internal higher education institutions. According to Article 27 of the Law of Ukraine No. 1556-VII "On Higher Education" (2014), institutions have the right to establish educational, scientific, industrial, and educational-scientific complexes, and science parks, be a part of consortia, all participants of which retain financial independence and the status of a legal entity. The commercialisation of innovation is a fairly effective mechanism for the development of higher educational institutions, scientific institutions, and individual researchers, and the practical implementation of their scientific findings both on the territory of Ukraine and abroad. According to A. Oke and F.A.P. Fernandes (2020), partner selection is based on an analysis of various aspects, including the assessment of reputable experts, a specialised database, publications, advertising materials, etc.

Automated information systems for the commercialisation of innovations in Ukraine were created to overcome problems of local, regional, and national nature. For example, the Ukrainian integrated technology transfer system (Ukrtechinform, 2023) is designed to accumulate and ensure the exchange of information about innovative products between the developer and the consumer. As S.L. Robertson (2022) states, the main goal of this organisation is to create conditions for the promotion of high-tech products, information technologies, and services to the internal and international markets, reduce the costs of higher education institutions to find

customers and partners, and ensure the legitimacy of concluded agreements on the results of studies. When creating this institution, the principles of building the Enterprise Europe Network (Chamber of Commerce and Industry of Ukraine, 2023) were observed. Thus, the activity of the Ukrainian integrated technology transfer system (Ukrtechinform, 2023) is related to the implementation of tasks in the segment of commercialisation of scientific findings and research of higher educational institutions and assistance in establishing technological cooperation. It is worth noting that the Agreement on cooperation in the field of technology transfer was signed in 2018 between the Ministry of Education and Science of Ukraine and the Academy of Technological Sciences of Ukraine (Pysarenko et al., 2018). During the period of validity of this Agreement, the Academy developed methodological and conceptual principles for the establishment of the National Technology Transfer Network, which were the basis for the operation of the pilot project – the Ukrainian technology transfer network (UTTN) and its corresponding segments.

According to P.J. Ramísio et al., (2019), to ensure a high level of efficiency in the implementation by higher education institutions of the processes of commercialisation of innovations and technological findings and inventions, appropriate centres should be established. It is worth agreeing with this opinion and predicting that their main goal will be to determine the feasibility of innovations, formalise copyrights, conclude license agreements, promote the creation of startup companies, and distribute royalties among participants in scientific development. As P. Goodyear (2022) states, the main result of the work of the centre for commercialisation of innovations of higher education institutions is to encourage researchers of these institutions to create scientific inventions and transfer them to industry, in which, accordingly, they would create a large flow of financial plan and contribute to the innovative development of the economy. That is, according to this position, increasing the level of functioning of the innovative economy is possible with the assistance and provision of conditions for the development of scientific-technical activities.

Among the problems that hinder the functioning of the centres for commercialisation of innovations in higher education institutions is the imperfection of the current legislation regulating this process, and the low level of demand for

research results in the field of industry in Ukraine. However, as a result of signing of the Association Agreement between Ukraine, on the one hand, and the European Union, the European Atomic Energy Community and their member states, on the other hand (Verkhovna Rada of Ukraine, 2014). This fact is confirmed by the recommendation of parliamentary hearings on legislative support for the development of the scientific-technical field of the state. Another problem that reduces the effectiveness of the commercialisation of studies in higher education institutions is post-Soviet attitudes. As noted by V. Kaputa et al., (2022), most teachers, supervisors, and researchers believe that the main task of an institute or university is to create new knowledge, but their implementation is entrusted to the state. This is an erroneous approach since the state and science must interact to commercialise scientific inventions and increase the level of the economy.

Attention should also be paid to the internal potential of higher education institutions, which consists of human, financial, material, and other resources. In other words, to create centres for the commercialisation of innovations at a university or institute, it is necessary to consider the legal status of the institution, its size, financial capabilities, and efficiency of implementation of activities. The royalties that the centre will receive should not be less than the cost of maintaining such a centre. Thus, to improve the level of the Ukrainian economy and the quality of educational services, the state needs to create innovative centres for the commercialisation of scientific inventions and findings based on higher educational institutions. In particular, these can be technology parks, clusters, and business incubators. In order for the activities of these centres to be implemented effectively, it is necessary to provide wide opportunities and favourable conditions for their functioning. This applies to making appropriate changes to the current legislation and introducing a new national policy. Due to this, Ukraine will be able to develop as a state with a high scientific-technical base, an innovative economy, and a high-quality educational system.

Conclusions

The conducted study, the purpose of which was to determine the conditions for the establishment of the innovative infrastructure of higher education institutions for the development of the state economy, provided an opportunity to identify several main aspects that will contribute to improving the efficiency of the educational

and economic systems of Ukraine through their harmonisation. Primarily, the main problems that hinder the development of innovation infrastructure in higher education institutions of Ukraine were identified. Among them, the shortage of personnel in universities, the post-Soviet mentality, the insufficient level of funding by the state and commercial enterprises of the scientific-technical base of higher education institutions, and the creation of subsidiaries are notable. The main forms of commercialisation of scientific inventions and findings in higher education institutions were considered to overcome them. The importance of this analysis is due to the fact that it provides an opportunity to create the most favourable conditions for the development of innovative infrastructures in higher education institutions on the territory of Ukraine. This will have a positive impact on the development of the economy of the state.

International experience in the mechanism of commercialisation of innovations, in particular, in Silicon Valley and Plastic Valley, was also considered. It was proved that in order for these forms of commercialisation centres to implement their activities most effectively, it is necessary to create favourable conditions and opportunities, in particular, to amend the current legislation of Ukraine in the field of higher education. It is also worth involving teachers, students, postgraduates, and graduates of higher educational institutions in the activities of innovative infrastructures. This will help to introduce non-standard innovative ideas that can then be implemented and commercialised. It is necessary to emphasise the need to create and further develop an innovative infrastructure of higher education institutions based on establishing interaction with the enterprise and private capital sectors. The offered recommendations will contribute to improving the quality of educational services provided by higher education institutions and developing the innovative economy of Ukraine. This will be due to the development of innovative infrastructure in higher education institutions and the corresponding commercialisation of their scientific inventions and findings. Further research will be aimed at analysing the activities of existing technology parks and clusters in higher education institutions in Ukraine.

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