

HIGHER EDUCATION

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HIGHER EDUCATION IN TIMES OF WAR: VECTORS OF INNOVATIVE DEVELOPMENT

Higher education is a key sphere that fosters resilience and ensures economic growth in the country. As Ukrainian higher education continued to evolve, the challenge of implementing modern innovative approaches and technologies in the educational process has become more prominent. Innovative activities have become perhaps the most critical area of higher education institutions' activities, as they enable the system to adapt absolutely to external factors. The aim of this article is to determine the features of innovative activities in higher education institutions in the context of Russia's military aggression and approaches to ensure its effectiveness. The following general scientific methods were used in the research: theoretical generalization, grouping, and systematization; analysis and synthesis; scientific abstraction; statistical method of data collection and analysis; graphical; induction and deduction. The article has provided an overview of higher education functioning in the conditions of war state, identified key threats, and assessed the impact of innovative activities in overcoming them. Approaches to ensuring the effectiveness of innovative activities in higher education institutions during the military aggression were proposed, and the key directions of their implementation have been identified and characterized.

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ВИЩА ОСВІТА В УМОВАХ ВІЙНИ: НАПРЯМИ ІННОВАЦІЙНОГО РОЗВИТКУ

Вища освіта – ключова сфера, яка формує стійкість та забезпечує економічне зростання країни. Що далі розвивалась українська вища освіта, тим яскравішою поставала проблема впровадження сучасних інноваційних підходів та технологій в освітній процес. А інноваційна діяльність стала чи не найважливішою сферою діяльності закладів вищої освіти, адже саме вона дає змогу досягнути максимальної адаптивності системи до зовнішніх факторів. Мета статті полягає у визначенні особливостей інноваційної діяльності закладів вищої освіти в умовах воєнної агресії РФ та підходів до забезпечення її ефективності. В рамках дослідження використано такі загальнонаукові методи: теоретичне узагальнення, групування та систематизація; аналізу та синтезу; наукового абстрагування; статистичний метод збору й аналізу інформації; графічний; індукції та дедукції. Надано характеристику функціонування сфери вищої освіти в умовах воєнного стану, ідентифіковано основні загрози та визначено вплив інноваційної діяльності на їх подолання. Запропоновано підходи до забезпечення ефективності інноваційної діяльності закладів вищої освіти в умовах воєнної агресії РФ, визначено та охарактеризовано ключові напрями їх реалізації.



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Keywords: innovative activities, higher education institution, higher education, digital transformation, military aggression, martial law.

Ключові слова: інноваційна діяльність, заклад вищої освіти, вища освіта, цифрова трансформація, воєнна агресія, воєнний стан.

JEL Classification: I 20, O 31, O 32.

Introduction

Higher education (HE) is a key sector that builds sustainability and ensures economic growth. It is here that professional staff is trained and research is carried out, which activates the innovation process. This sphere shapes the future of Ukraine, influences its social and economic processes, and at the same time requires constant development and modernization to meet the requirements of the modern world and respond effectively to changes.

The transformation of HE in Ukraine is a phenomenon that has been going on with varying intensity since 1991, but over the past decade, a number of events have taken place that have become decisive and paved the way for further development of the sector, namely: the adoption of the new Law of Ukraine "On Higher Education" (2014), granting greater autonomy to higher education institutions (HEIs), the global COVID-19 pandemic, and the outbreak of a full-scale war. All these factors made adjustments to the genesis and conceptual framework for the further development of education.

The further the Ukrainian higher education system developed, the more vividly the problem of introducing modern innovative approaches and technologies into the educational process became. And innovation has become one of the most important areas of HEI activity, as it allows for maximum adaptability of the system to external factors.

In general, Ukrainian legislation interprets innovation activity as "aimed at the use and commercialization of research and development results and leading to the launch of new competitive goods and services" (Law of Ukraine "On Innovation Activity", 2002). In the scientific literature, innovation activity is defined as "all scientific, technological, organizational, financial and commercial activities that actually lead to innovation or are conceived for this purpose" (Mazur, Sulima, 2020).

The issue of innovation activities of higher education institutions is quite popular among scientists and is actively studied by domestic and foreign authors. For example, Boltyanska N. and Boltyansky O. (2020) in their work characterize an innovative university and define its role in Ukraine's integration into the European educational and scientific space. In turn, the team of scientists Prokopova O., Lyaska O. and Holinei V. (2023) analyze in detail the innovative component of higher education and propose a set of innovative approaches to the functioning of higher education institutions.

Among the foreign scholars dealing with similar issues, we can highlight the work of Ocampo, L., Aro, J.L. and others (2022), in which they study the factors that influence the productivity of research and innovation potential of higher education institutions and identify the key ones based on matrix analysis. In addition, Li, Chen, and Alrasheedi (2023) studied collaborative innovation systems in educational institutions, which are created by integrating numerous elements in a certain order.

At the same time, the specific issue of innovative development of higher education institutions in wartime remains underdeveloped, and most publications are presentations at forums, conferences, etc. One of the few scientific articles that examine this issue is the work of Horash K. (2023), in which the author characterized the innovations of modernization and transformation in HEIs and justified the feasibility of their application. In addition, it was determined that innovation is a priority area for ensuring the competitiveness of the institution in the postwar period. Given the lack of sufficient scientific publications on this issue and its relevance, it requires more active scientific discourse and new developments.

The aim of the article is to determine the peculiarities of the innovative activity of higher education institutions in the context of the military aggression of the Russian Federation and the directions for improving its efficiency.

The following general scientific methods were used in the study such as: theoretical generalization, grouping and systematization; analysis and synthesis, to form directions for ensuring the effectiveness of innovation activities of higher education institutions; scientific abstraction, to determine the key measures for implementing the proposed directions; statistical method of collecting and analyzing information, to study the performance indicators of certain aspects of innovation activities of higher education institutions, graphical method, to visualize the trends and dynamics of the analyzed indicators.

In the article it was proposed a hypothesis about the possibility of increasing the effectiveness of innovative activities of institutions in the context of military aggression of the Russian Federation through comprehensive digitalization of the educational process and administration, while strengthening international cooperation and intensifying research work, which is focused on the post-war reconstruction of the country and integration into the EU.

The information base of the research was based on the scientific works of Ukrainian and foreign scholars, analytical materials of Ukrainian and international organizations and institutions, open access electronic databases, etc.

The main part of the article consists of two sections. The first section describes the functioning of the higher education sector under martial law, identifies the main threats and determines the impact of innovation on overcoming them. The second section proposes directions for improving the

efficiency of innovation activities of higher education institutions in the context of military aggression of the Russian Federation, identifies and characterizes the key measures for their implementation.

1. Functioning of higher education in the conditions of war

The military invasion of Russia in February 2022 shifted the focus in all areas of the country's economy and the lives of its citizens. As of June 2023, according to a study by the Kyiv School of Economics, the amount of direct damage caused to the Ukrainian economy amounted to USD 150.5 billion, while indirect losses (loss of income in various sectors during the war and in the future) reached USD 265.6 billion. The country's education sector lost USD 9.7 billion and USD 2.1 billion, respectively (Kyiv School of Economics, 2023). However, despite this, with the help of international partners, the Ukrainian economy continues to struggle and, according to the World Bank, in 2023, it reached GDP growth of 3.5%, and in 2024 this figure will be 4% (World Bank, 2023).

Higher education in the context of military aggression in Russia has faced new challenges and problems, namely

- destruction of infrastructure as a result of hostilities and missile attacks;
- the outflow of intellectual resources abroad, some of which have returned and some have remained in other countries;
- disruption of partnerships between educational institutions, businesses, and research institutions due to the occupation of certain parts of the country;
- energy crisis caused by massive rocket attacks on the country's critical infrastructure;
- lack of opportunities for full-time education due to the threat to the life and health of participants in the educational process;
- financial crisis caused by the conversion of the economy to martial law and the allocation of state funding to the defense sector.

Each of the above challenges had a significant impact on the functioning of higher education institutions under martial law and required strategic and operational solutions. At the same time, at the time of the outbreak of full-scale war, Ukrainian HEIs were already in the process of profound transformation caused by the global trend toward digitalization and the effects of the COVID-19 pandemic. Most higher education institutions were able to set up their work remotely, and this became a kind of "airbag" during the first months of the war and the energy terror in the winter of 2023.

At present, higher education institutions are operating in experimental conditions, as it is difficult to predict what will happen in the near future. At the same time, they face a number of priorities, namely

- ensuring safety conditions for staff and applicants;
- filling the contingent of applicants;

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- support for the human and intellectual potential of the institution;
- rethinking the areas of training taking into account changes in priority sectors of the economy;
- development and updating of the institution's development strategies taking into account the wartime and post-war periods, etc.

Despite all the negative and destructive factors caused by the aggression of the Russian Federation, Ukrainian higher education institutions must continue their transformation in order to achieve European standards of higher education and full integration into the European educational area. A positive achievement is that in 2023, one of the world's most famous university rankings, the Times Higher Education World University Rankings (THE WUR), published annually by the British magazine Times Higher Education, included 14 Ukrainian PDJs for the first time (*Figure 1*), which is 4 more than in 2021 and 2022. The increase in the presence of Ukrainian institutions in this ranking is due to the existing positive trends in higher education, despite the negative impact of the war, such as digitalization of education, intensification of research activities, strengthening of international cooperation, etc.

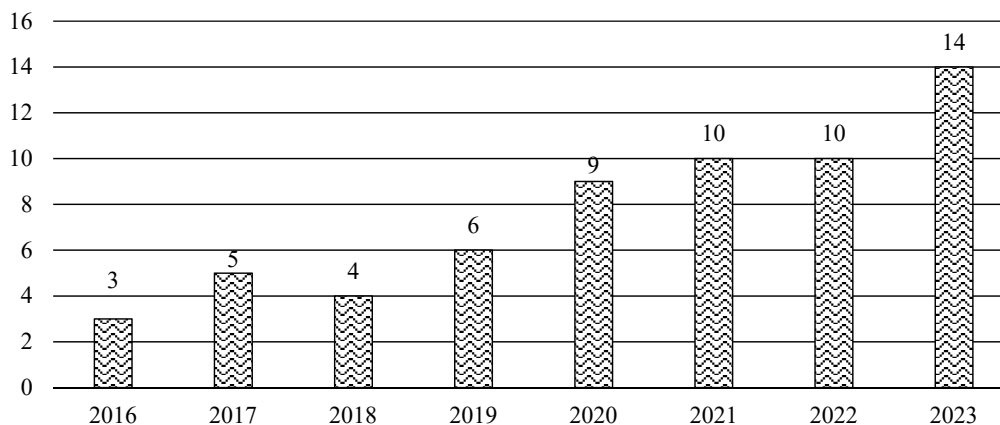


Figure 1. Presence of Ukrainian higher education institutions in the Times Higher Education World University Rankings for 2016–2023

Source: Times Higher Education, 2023a.

The Times Higher Education World University Rankings methodology is based on five main criteria:

- educational environment (weight of 29.5%): assesses the quality of education and the educational environment, including the reputational capital of the educational process, the ratio of teachers to students, the percentage of graduates with doctoral degrees, and the financial condition of the institution;
- research environment (weight of the criterion – 29%): takes into account the reputational capital in the field of research, income from research activities and their productivity;

- research quality (weight of the criterion – 30%): includes the level of citation, quality of research results and their impact on the economy;
- international activities (weight of the criterion – 7.5%): assesses the global integration of the university through the share of international students and faculty, as well as international cooperation;
- industrial impact (weight of the criterion – 4%): measures the university's interaction with industry, including commercialization revenues and the number of patents (6). These criteria allow us to evaluate universities on various aspects of their activities, from the quality of education to research capacity and international cooperation (Times Higher Education, 2023b).

Having analyzed the above ranking methodology, we can see that each criterion is directly related to the innovation activities of the HEI, because in the modern world, universities are the main providers of innovation through educational and research activities. Thus, institutions engaged in advanced research and development of new technologies actively cooperate with the private sector, attracting investment in research and development, participate in international grant programs and research projects, introduce innovative approaches to the educational process, have more opportunities for development (Marmaza, 2019) and, accordingly, better results in international ranking assessment. What will ensure the further development of higher education and increase the presence of Ukrainian higher education institutions in international rankings? The answer is obvious to increase innovation and further digital transformation of institutions.

2. Key areas for improving the efficiency of innovation activities

Currently, Ukrainian HEIs are in an extremely volatile environment. The defining aspect of the functioning of higher education institutions is their innovativeness. This is due not only to the global movement towards Industry X.0 (Kraus, Kraus & Stepa, 2021), but also to the need to adapt quickly to changes, which is possible through the introduction of innovative technologies and methods. In order to ensure maximum sustainability in such conditions, higher education institutions should implement a set of measures.

Comprehensive digitalization of the educational process and administration. Digital platforms used for distance learning are especially important in wartime. Students and teachers can continue the educational process regardless of their physical location. In turn, digital educational platforms can easily adapt to changes in curricula, teaching methods, and assessment, which allows for a quick response to the demands of time and the economy. The digitalization of administrative processes can simplify university management, optimize communication between structural units, and reduce the time spent on bureaucratic procedures;

Strengthening international cooperation. International partners can provide financial, technical, and educational support to Ukrainian higher education institutions to help them continue their educational activities

during the war. Such cooperation can provide access to advanced online learning platforms and research resources, which is especially important in wartime, and will play a key role in the post-war reconstruction and modernization of the infrastructure of higher education institutions;

Intensification of research activities. Active research and development activities can attract funding from public, private and international sources, especially in areas that are important for solving contemporary problems, including those arising from the war, and lead to the development of new technologies and innovations in these areas. In addition, the integration of research into the educational process ensures the relevance and practical significance of education, and students have the opportunity to engage in real research, which improves its quality.

2.1. Comprehensive digitalization of the educational process and administration

As part of the implementation of the direction "Comprehensive digitalization of the educational process and administration", the HEI should ensure systematic work on the formation and development of information and communication networks and the integration of various technological tools (*Figure 2*).

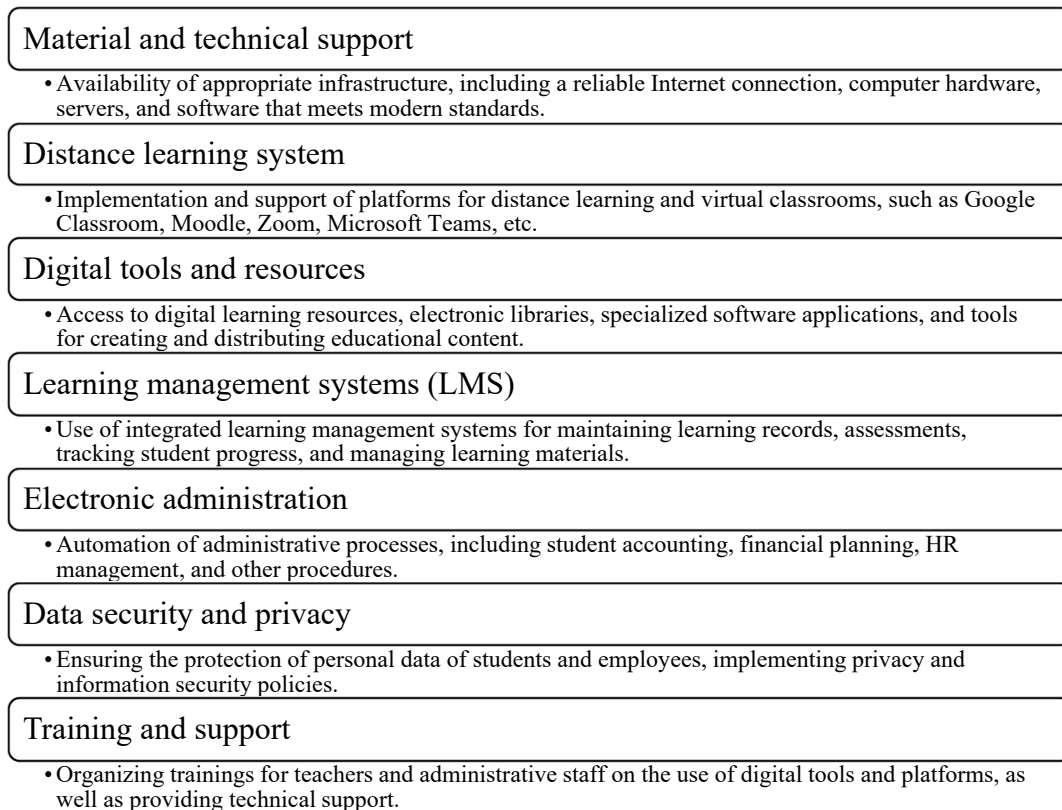


Figure 2. Components of comprehensive digitalization of the educational process and administration of higher education institutions

Source: author's development.

It is clear that the implementation of modern technological solutions in the educational process may require significant financial resources. This is especially true when it comes to updating material and technological support, and given the realities of today, despite the declared financial autonomy of higher education institutions, there are significant barriers in procurement processes, which have only intensified with the economic crisis caused by the full-scale invasion of Russia.

On the other hand, such financial investments have a significant impact on improving the quality of education in the institution and create additional advantages for it in the market of educational services (Rapanta, Botturi, Goodyear, 2020). In addition, the introduction of innovative technologies in the educational process will allow higher education institutions to move to a qualitatively new level, creating a new educational model that, unlike the traditional one, will allow solving a much wider range of tasks and achieving new results (Escorcia Guzman, Zuluaga-Ortiz, Barrios-Miranda & Delahoz-Dominguez, 2022).

International grant programs and projects that are actively working in the field of digital transformation of educational spaces and provide financial and advisory support for transformations can be an effective mechanism in the face of significant limitations in their own financial resources.

2.2. Strengthening international cooperation

Strengthening international cooperation is extremely important for ensuring the innovation activities of higher education institutions in the context of military aggression by the Russian Federation. International partners can provide the necessary support and resources, such as funding, knowledge exchange, access to scientific equipment and technologies, etc.

Over the last decade, the trend of creating university alliances, associations of higher education institutions, has been actively implemented in the world. International university alliances consist of different countries based on active international cooperation and unification of research and educational activities. This form of international cooperation allows achieving leadership positions by attracting foreign students and researchers, joint projects, and international educational programs (Artemov, 2021). Such alliances can be formed on the basis of different organizational and legal forms.

An example of such integration is The European University Association (EUA), which unites more than 850 higher education institutions from 49 European countries. The members of the association exchange best practices participate in joint projects and events to strengthen international cooperation and develop the European Education Area (European University Association, 2023). Some Ukrainian HEIs are also members of this international association at different levels of membership and receive

additional opportunities to establish international cooperation.

While international university alliances are more of a long-term game, international grant programs and projects are more effective in terms of the speed of results. In the HE field, one of the most well-known is the Erasmus+ grant program. It has a wide range of areas from academic mobility to infrastructure projects to modernize the educational environment. For example, during 2015–2022, in the KA2: Capacity Building in the Field of Higher Education, Ukrainian grantees have implemented or are implementing more than 80 infrastructure projects worth more than €50 million (National Erasmus+ Network, 2023). Given the intensification of international partners with the beginning of the full-scale invasion of Russia and the priority of the Ukrainian economy's recovery, new support and recovery grant programs are emerging that can be used by HEIs on a project basis.

In general, strengthening the international activities of higher education institutions in the context of Russia's military aggression in any form (through grants, international mobility of students and teachers, joint research projects) allows the institution to attract more financial, intellectual or information resources, strengthen innovation, ensure effective development and improve the quality of education.

2.3. Intensification of research and development activities

The intensification of research activities of higher education institutions is a process that has a number of components, as shown in *Figure 3*.



Figure 3. Components of intensification of research activities of higher education institutions

Source: author's development.

The interdisciplinary approach is quite actively used in Europe, as it allows combining the best practices of several different scientific fields and creating a new innovative product. For example, the European Commission’s document "Commission Communication on a European strategy for universities" (2022) defines the interdisciplinary approach as one of the key ones in the development of higher education institutions within the European Education Area. The modern world requires modern solutions. Many global challenges (such as climate change, health, economic development, defense technologies) require an integrated approach, and interdisciplinary allows for more effective development of comprehensive solutions to these challenges.

Increased publication activity stimulates research activities through the exchange of knowledge and ideas in the scientific community. In addition, publications in journals indexed by international scientometric databases provide visibility of research at the global level, open up new opportunities for international cooperation, and have a positive impact on the presence of higher education institutions in international rankings. If we analyze the publication activity of Ukrainian scientific and educational institutions since 2016 (Figure 4), we can see a significant increase in the number of publications (by 34 %) in 2019. After that, there was a slowdown in publication activity, but the trend remained positive until 2022. With the beginning of the full-scale aggression of the Russian Federation, the publication activity of Ukrainian scientists fell sharply in 2022 (by 10.3 %). At the beginning of 2022, the indicators of publication activity do not reflect the full picture, as indexing of individual sources may still be ongoing, although the downward trend in performance is evident.

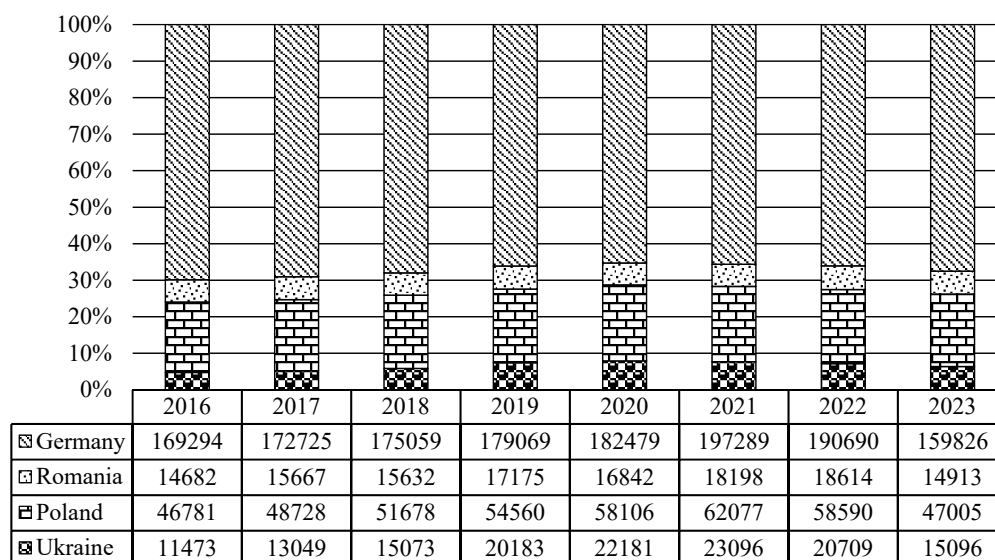


Figure 4. Publication activity in Scopus of scientific and educational institutions in 2016–2023

Source: author’s development based on (Scopus, n. d.).

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Having analyzed the publication activity of Ukrainian institutions and a number of European countries (Poland, Romania, and Germany), we can see that we are currently on a par with Romanian scientific and educational institutions, while the results of Poland are almost three times higher. This indicates that there is a significant potential for growth and development in the field of research and increased publication activity in Ukraine. It is important to consider this problem comprehensively and systematically, because the number and, most importantly, the quality of scientific publications depend on the level and scope of research and the availability of material and technical resources. Therefore, it is worth noting that increased publication activity is rather a consequence of effective research and development.

Patenting the results of research activities in higher education institutions contributes to the commercialization of an innovative product, which not only provides additional financial resources for universities but also stimulates the innovative development of the institution as a whole. Protection of intellectual property is an important aspect in the context of global competition. In addition, active patenting enhances the university's reputation globally, attracts talented researchers and students who want to work in an innovative environment where their intellectual property rights to inventions or ideas are fully protected. It also motivates researchers and students to engage in practice-oriented research, as they have a clear understanding of the potential commercial value of their work.

As for the patent activity of higher education institutions, according to the UANIPIO (SIS) Special Information System (SIS), there was a positive trend in the number of registered titles of protection for inventions and utility models in 2016–2019. But in 2019, there was a sharp drop (by 29.4 %), after which patent activity hit a "peak" with an annual decrease of more than 25 % (*Figure 5*).

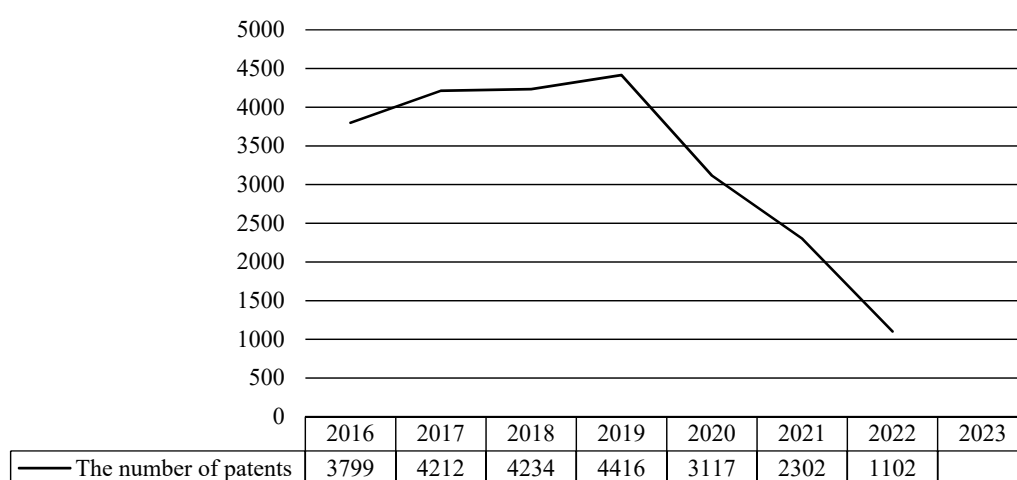


Figure 5. Patent activity of Ukrainian higher education institutions in 2016–2023

Data for 2023 are not available.

Source: author's own elaboration based on (UANIPIO (SIS), n. d.)

In general, the decline in patent activity in 2019 is a global trend caused by the COVID-19 pandemic, but according to a study by the World Intellectual Property Organization (WIPO), it amounted to only 7.2 % globally and was followed in 2020 by an increase in the number of registered titles of protection for inventions and utility models by 8.4 % (WIPO, 2023). At present, global patent activity continues to show positive dynamics, which indicates the need to search for problematic aspects in Ukrainian practice and develop effective approaches to improving the situation.

Intensification of partnership with the business sector in the context of the military aggression of the Russian Federation is another important step to intensify research work in higher education institutions. Such cooperation can provide additional financial and material resources, which is especially critical in times of limited budget funding. Partnerships with businesses allow universities to focus on applied research that meets real market needs, promoting the commercialization of scientific developments and innovations. In particular, such cooperation can contribute to the development of technologies and solutions that will help the country in wartime, for example, in the areas of cybersecurity, defense, medicine, agrotechnology, etc. This not only strengthens the country's defense capabilities, but also stimulates scientific and technological development, increasing the overall level of innovation and competitiveness of the national economy.

The development of research infrastructure in higher education institutions is almost crucial for intensifying research, as it provides researchers with access to modern equipment and technologies that are keys to conducting quality research. The presence of high-tech laboratories and research centers facilitates the performance of complex experiments and the development of innovations that can be used in wartime to develop defense systems, medical innovations, or other critical projects, among other things. Universities with a strong research infrastructure can effectively attract both national and international funding.

Conclusions

Russia's military aggression has shaken all sectors of the country's economy, including higher education. Against the backdrop of recovery from COVID-19, the war had a devastating effect on many aspects of the HEI's activities: staff outflow, destruction of infrastructure facilities, and disruption of partnerships. At the same time, digital transformation, which has only intensified in the post-COVID recovery, has helped to somewhat reduce the destructive impact of the first months of the war and the winter energy terror.

Innovation is becoming a key driver of HEI development in such a changing environment. It opens up additional opportunities for funding and creates prerequisites for improving the quality of education.

In the context of the military aggression of the Russian Federation and the instability of the external environment, the following areas of improving

the efficiency of innovation activities of higher education institutions are proposed: digitalization of the educational process and administration, strengthening of international cooperation, intensification of research activities.

Implementation of the proposed directions will allow the HEI not only to provide opportunities for effective functioning, but also to continue the qualitative transformation in order to achieve the necessary level of development to successfully join the European educational area as a leader, not an outsider. At the same time, the study of the specifics of the innovation activities of higher education institutions in the context of the military aggression of the Russian Federation and in the post-war period is still relevant and requires further scientific discourse. In the framework of future research, it is important to ensure that approaches and practical recommendations are relevant and adequate to the level of challenges that the higher education sector faces as hostilities continue. That is why constant scientific monitoring and analysis of specific development trends should update the conceptual approaches to the implementation of innovative activities of higher education institutions and the functioning of the higher education sector in general. And the results of this scientific discourse should become the basis for the formation or refinement of conceptual development strategies.

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