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### Economic situation and prospects for the development of higher education in Ukraine in the context of post-war recovery

**Oleg Kuklin\***

Doctor of Economics, Professor

Cherkasy State Business College

18000, 243 Vyacheslav Chornovol Str., Cherkasy, Ukraine

<https://orcid.org/0000-0001-6904-3496>

**Abstract.** The purpose of this study was to investigate the financial aspects of the functioning of higher education in Ukraine and to find ways to restore it in the post-war period. A study of the financial situation of Ukrainian higher education institutions, national, private, and international funding programmes was conducted. The study found that the restoration of higher education in Ukraine after the war is directly related to the resources and support strategies coming from public, private, and international sources. It was found that the physical destruction of universities does not exhaust the scope of the problem: in parallel, there is an outflow of teaching staff due to low salaries and insufficient prospects, as well as a deepening crisis of management models that are unable to respond quickly to the requirements of the post-war period. It was concluded that financial support and mechanisms for attracting private capital can only partially address the pressing issues, as more flexible learning formats and systemic changes in the organisation of the educational process are needed. In this regard, it was suggested that innovative approaches to education should be considered as one of the determining factors of sustainability, especially in terms of distance and blended learning formats that can help overcome the limitations of access to infrastructure. Therewith, regardless of the source of funding and the form of resource mobilisation, the need to preserve the scientific and pedagogical potential and to update the content of programmes to meet the challenges was identified. As a result, recommendations were formulated with a set of measures aimed at restoring the learning environment and its further development in the post-war period. The findings pointed to the need for a comprehensive approach to the restoration and modernisation of higher education in Ukraine through multichannel financing, updating curricula, and preserving the scientific and pedagogical potential

**Keywords:** public-private partnership; innovations; energy efficiency; sources of financing; infrastructure rehabilitation

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\*Corresponding author

## Introduction

The higher education system is one of the key factors in the development of human capital, which is the basis for economic and social growth in any country. Russia's full-scale aggression against Ukraine has led to widespread destruction, a serious economic downturn, and destabilisation of many areas of life, including education. Infrastructure losses, funding cuts, and the outflow of young people have become challenges that require immediate response and a rethinking of the role of the education system in the country's recovery.

In the context of a long-term military conflict, Ukraine has demonstrated a unique experience of confronting challenges and at the same time working on reforming and adapting the education sector to new realities. Of particular significance in this process is the higher education system, which provides training of qualified personnel for critical sectors of the economy and contributes to strengthening the country's intellectual potential. In such a situation, the study of economic aspects of the functioning and development of the higher education system is a necessary step to identify stabilisation mechanisms, attract additional resources, and formulate a sustainable recovery strategy.

Studies on education and science financing in Ukraine have highlighted the urgency of long-term problems caused by economic instability and the impact of military operations. O.L. Totska & I.O. Tytarenko (2023) noted that the reorientation of the state budget towards defence needs has created a considerable resource gap in the education sector, which threatens the stability of educational institutions and their ability to restore infrastructure and modernise programmes. At the same time, the researchers pointed to opportunities to attract international support and optimise spending to overcome these challenges. T.K. Kuranda & O.P. Kochetkova (2021) focused on the imbalance in the distribution of funds and the lack of support for basic research, which weakens the country's competitiveness in the international arena. These studies pointed to the need to develop grant programmes, international cooperation, and the introduction of effective financial mechanisms. However, the issue of attracting international financing models, adapting to the challenges of digitalisation and changes in the structure of demand for knowledge is still understudied. This requires further research to develop comprehensive strategies that will ensure sustainability and development in these areas.

Internationalisation and international cooperation in higher education is a significant area of development of modern universities aimed at improving the quality of education and entering the global educational space (Shahini, 2024). H. de Wit & P.G. Altbach (2021) focused on the challenges and opportunities of internationalisation of higher education and global trends in its development. The researchers found that the key elements of effective international cooperation are the mobility of students and teachers, the adaptation of curricula to international standards, and the use of digital technologies to expand access to the global educational space. At the same time, the

researchers noted that inequality of access to these opportunities is becoming a serious barrier for many educational institutions. H. de Wit & G. Merckx (2022) analysed the historical aspects of internationalisation and its effects on global education. The researchers revealed the stages of evolution of international cooperation, including periods of technological breakthroughs and global conflicts that affected the nature of educational relations. The study demonstrated that internationalisation has become an integral component of educational development, contributing to the development of global academic networks and improving the quality of education.

Since human capital plays a significant role in shaping economic and social development, its quality characteristics considerably affects the ability of regions to adapt to challenges. C. Diebolt & R. Hippe (2019) investigated the relationship between the level of investment in human capital and innovation activity in European regions and found that educational systems that build competencies required in high-tech industries contribute to sustainable economic growth. N. Slaviuk & T. Bui (2022) studied the consequences of the war for Ukraine's economy, including the loss of human capital and changes in economic priorities, and concluded that, despite the large-scale destruction, transformations in the structure of the economy can contribute to the development of new industries and digital technologies. Therewith, the researchers stressed the significance of international support to restore human capital and ensure its role in rebuilding Ukraine's economy. The question of how to engage post-conflict economies in the global market while preserving their innovation potential stays unresolved.

Existing approaches to education management and modernisation reflect the desire to adapt the system to global and technological challenges. L. Li (2020) examined how digitalisation and automation are shaping the requirements for educational systems in the context of the fourth industrial revolution. The researcher addressed the need for effective coordination between educational institutions and labour market needs to ensure that specialists are trained for a technology-oriented environment. The development of partnerships between universities and businesses is a key element in creating a competitive educational ecosystem. H.E. Fitzgerald *et al.* (2019) emphasised the significance of universities' interaction with society as a key aspect for improving the quality of education and its relevance to modern challenges, as partnerships, interdisciplinarity, and openness promote critical thinking among students and provide a link between theory and practice. This approach is aimed at creating a sustainable educational ecosystem capable of adapting to rapid changes. M. Tight (2019) investigated the influence of neoliberal ideology on the higher education system and the problem of commercialisation, which reduces the accessibility of education for the general population. Despite these challenges, the researcher emphasised the significance of policies that enable a balance between economic efficiency and the social mission of

education. However, the problem of the interaction between conventional educational models and innovative approaches is still understudied.

The reviewed studies revealed a considerable academic interest in such aspects as internationalisation of education, the effects of human capital on economic development, and the modernisation of educational systems. At the same time, the issues of combining educational and financial models in the context of post-war recovery stay understudied, which is especially relevant for countries affected by military conflicts.

The purpose of this study was to assess the effects of current economic challenges on the higher education system of Ukraine and to identify ways to adapt and develop it in the period of post-war recovery. To fulfil this purpose, the following objectives were set: to investigate the effects of the war on the financial and infrastructural components of educational institutions; to analyse current challenges, such as reduced state funding and declining student numbers; to develop recommendations for attracting additional resources and creating conditions for sustainable development of the educational system.

## Materials and Methods

The study conducted a comprehensive analysis that covered the financial situation of higher education institutions (HEIs) in Ukraine, including the analysis of official statistics from the reports of the State Statistics Service and documents of international organisations such as the United Nations, the United Nations Educational, Scientific and Cultural Organisation (UNESCO) and the World Bank (2023) (Education in Ukraine..., 2023; Network and activity..., 2024; Ukraine: Restoring scientific..., 2024). The impact of the hostilities on other sectors of the Ukrainian economy was also considered and the relationship between them and education was outlined (Kyiv City Council..., 2024). This stage helped to assess the level of funding for educational institutions, determine the extent of underfunding and priorities for budget allocations in the context of post-war recovery.

Another significant step was to study the impact of the war on university infrastructure. For this, reports from government agencies, international organisations, and independent experts were analysed, including data on physical destruction, including university buildings, dormitories, and laboratories (Ukraine: Restoring scientific..., 2024; Ukraine: More than..., 2024; Centre for Political Analysis "Observatory of Democracy", 2024; From ruined buildings..., 2024). The study of the issue of damage and restoration of the physical infrastructure of higher education institutions also included an analysis of materials from Education.ua, Vsesvita, Evening Kyiv, Gwara Media (Shevchenko National University..., 2023; Katayeva, 2023; 11 universities destroyed..., 2024; Bykova, 2024)

Changes in the structure of demand for specialities in higher education institutions were investigated separately. This analysis was based on information from official

sources, such as registers of entrants (and a study of the state of Ukrainian science and scientists during the war, which helped to identify key trends in the choice of professions (Network and activity..., 2024; Galagan *et al.*, 2024). The socio-economic factors that influence these changes were considered, and conclusions were drawn on how to adapt curricula to the new conditions.

To determine the level of international support for the Ukrainian higher education system, the study analysed available grant programmes, initiatives of the European Union (EU) and the North Atlantic Treaty Organisation (NATO) from the materials of the Ministry of Education and Science of Ukraine and other organisations aimed at developing research, modernising infrastructure, and introducing innovations (The international community..., 2022; Cabinet of Ministers..., 2022; Science for peace..., 2023; Scottish initiative donates..., 2024; Over 13 million..., 2024; Vynnychuk, 2024). The problems of attracting teaching staff were also investigated. For this, the reasons for the mass departure of specialists abroad were analysed: salaries, inflation, and reduced funding for research (Higher education employee..., 2024; Job salaries according to..., 2024; The effects of war..., 2024; Inflation index in..., n.d.).

The public-private partnership between Ukrainian HEIs and business was considered, which demonstrated the possibility of attracting additional financial resources to support the educational system and the prospects for improving the quality of training (especially technical specialties) through close cooperation with leading corporations (e.g., Boeing Ukraine and Samsung Electronics) (Rector's report for..., 2019; How it's made, 2020; Lviv Polytechnic has..., 2021). The review of state initiatives aimed at adapting the higher education system to the conditions of war and post-war reconstruction revealed measures to ensure the continuity of the educational process, such as the introduction of distance and hybrid learning models, as well as the creation of conditions for the relocation of universities from the temporarily occupied territories. The legal framework governing these processes and its compliance with European standards in the field of higher education were also considered (Vintonyak, 2024). The review of the leading international programmes for the integration of the Ukrainian higher education system into the global educational space included the following programmes: Erasmus+ (2024) and German Academic Exchange Service (2024), Fulbright Ukraine (2024) and Horizon Europe (European Commission, 2024). The example of accreditation of educational programmes according to European standards National Agency for Quality Assurance in Higher Education (2024) confirmed the compliance of Ukrainian universities with international quality requirements.

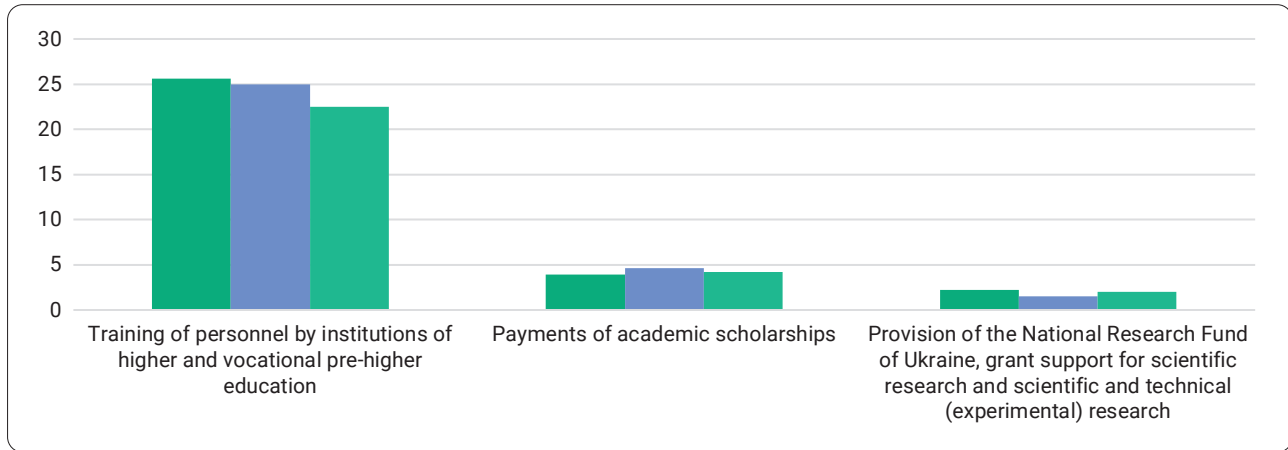
## Results

### State of the economy of higher education in Ukraine in the active phase of military operations

The study of the financial situation of Ukrainian higher

education institutions in the context of post-war recovery revealed numerous challenges that substantially affected the stability and functioning of this sector. One of the key factors is the significant underfunding and reduction of budget expenditures, which resulted from the general economic downturn in the country. Budgetary allocations for

education have declined due to the reorientation of public resources to military needs and support for other critical sectors, which has limited the ability of higher education institutions to maintain the adequate level of quality of education, modernise infrastructure, and ensure international competitiveness (Fig. 1).



**Figure 1.** Public spending on education and science in 2021-2023, UAH billion

**Source:** created by the authors of this study based on the State budget for 2023 (2022)

The Russian-Ukrainian war caused significant physical damage to the infrastructure of many universities, especially in the regions that have been subject to active hostilities. Specifically, V.N. Karazin Kharkiv National University, National Technical University “Kharkiv Polytechnic Institute”, and Mariupol State University suffered severe damage (Centre for Political Analysis “Observatory of Democracy”, 2024; From ruined buildings..., 2024). The destruction of buildings has made it impossible to conduct the educational process in the conventional format, while the cost of restoring scientific infrastructure could reach more than USD 1.26 billion, but there are no clear calculations due to the ongoing hostilities (Ukraine: Restoring scientific..., 2024). Furthermore, the lack of a clear strategy for restoring infrastructure complicates the effective use of the available funds.

Another substantial problem is the decline in the number of students (Network and activity..., 2024). Internally displaced persons, as well as citizens who fled the country due to the war, have substantially reduced enrolment in higher education institutions. This has affected university revenues from contract education, which is a substantial source of funding for many institutions. Inequality in access to education among students from the affected regions has also increased, creating additional social challenges for the higher education system. The government is seeking to compensate for this inequality by introducing benefits for internally displaced persons, such as a simplified procedure for admission to higher education institutions and financial support for education.

The war has greatly affected the economic situation of Ukraine’s education system, specifically in terms of

research funding and modernisation of educational institutions. Apart from the migration of Ukrainian scientists, the reduction in investment in research has become one of the most visible consequences of the economic crisis caused by the war (The effects of..., 2024). Furthermore, HEIs were forced to reduce or completely stop funding research projects as the priority was shifted to meeting basic educational needs and restoring damaged infrastructure (Galagan *et al.*, 2024), which particularly affected international cooperation, which in previous years had provided a significant contribution to the development of scientific potential.

The cost of rebuilding damaged or destroyed educational facilities has also become a critical issue: restoring buildings and purchasing the necessary equipment requires extensive financial resources, which are currently limited due to the overall state budget deficit. In the absence of clear mechanisms for attracting additional funding, Ukrainian education has faced the need to attract private investors and international organisations such as UNESCO or the European Investment Bank (EIB) (Education in Ukraine..., 2023; Ukraine: More than..., 2024).

The need to modernise educational institutions has become especially significant in the wake of the transition to digital technologies and changing educational priorities. The war has accelerated the need to create hybrid learning models that will ensure continuous access to education even in emergency situations, but limited resources and insufficient technical support complicate the implementation of such changes. Specifically, many universities do not have adequate access to modern software and equipment, which reduces their competitiveness in the international arena.

The overall impact of the war on the education economy in Ukraine has been manifested in a decline in investment in research, excessive costs of restoring damaged facilities, and the need to modernise educational processes and facilities. These challenges require a comprehensive approach to addressing them, involving both national and international resources. Notably, the restoration of the higher education system in Ukraine is part of the broader process of economic recovery after the war. For comparison, other key sectors of the economy, such as energy and transport, are also in a state of recovery, but have their specific features and priorities.

The energy sector suffered the greatest losses due to targeted attacks on energy infrastructure. According to the Kyiv City Council, more than 50% of the city's power grids were damaged by Russian shelling, and the total loss of electricity generation was 75%, which created the need for significant investment in renewable energy sources and grid reconstruction (Kyiv City Council..., 2024). At the same time, higher education is less dependent on physical infrastructure, which allows it to adapt more quickly to the transition to digital formats.

The transport infrastructure, including roads and railways, has also been affected by the active hostilities:

Ukraine's transport network needs a thorough rehabilitation, including both physical reconstruction and modernisation of logistics processes due to the closure of air routes and the occupation of a series of ports in the Sea of Azov. In comparison, higher education faces more complex challenges related not only to physical recovery but also to ensuring international competitiveness.

The specific feature of the recovery of higher education is that it underlies the development of human capital, which is necessary for the sustainable recovery of all other sectors. It is known that in post-war recovery, investment in education plays a significant role in stabilising society and building a skilled workforce (World Bank, 2005; Milton & Barakat, 2016). At the same time, energy and transport demonstrate a faster economic impact due to their direct influence on infrastructure rehabilitation and meeting basic economic needs. However, these sectors depend on skilled workers trained in the higher education system, which highlights the interdependence of different areas of economic recovery. Thus, while the recovery of different sectors of the economy in Ukraine has its unique challenges and opportunities, higher education is still key to ensuring sustainable and long-term economic growth (Table 1).

**Table 1.** Role of state policy and international aid in the restoration and development of higher education in Ukraine

Aid area	National programmes to support higher education institutions	International aid for higher education institutions
Ensuring continuity of education and access to innovation	Relocation of educational institutions from the temporarily occupied and especially dangerous territories, ensuring safe conditions for the educational process.	Horizon Europe programme: participation of Ukrainian scientists in research and innovation projects on an equal footing with EU member states.
Adaptation to war conditions and development of security studies	Holding an admission campaign in a new format, including testing abroad, and adapting to the war.	NATO's Science for Peace and Security (SPS) Programme: 2025 call for proposals for research that addresses security needs.
Management and financial support for innovative projects	Practical support in the management of higher and vocational pre-higher education institutions.	LIFE Programme 2021-2027: grants from 700 thousand to EUR 20 million with the possibility of co-financing up to 95% of the project cost.
Infrastructure recovery and energy efficiency	Financial support through subventions for the restoration of damaged educational institutions aimed at reconstructing dormitories and educational buildings.	Funding through the EIB: the Higher Education of Ukraine programme provides for investments in energy efficiency at universities.
Financial stability and technical support	Temporary exemption from real estate taxes for higher education institutions, which allows them to redirect funds to priority needs.	Assistance to Reusing IT: launching the Unbreakable Education programme, which provided equipment for distance learning and support for educational initiatives.

**Source:** created by the authors of this study based on Cabinet of Ministers of Ukraine Order No. 286-r (2022), The international community will strengthen support for Ukrainian scientists (2022), Science for peace and security programme (2023), Scottish initiative donates 2,000 computers to Ukrainian schools (2024), Over 13 million euros for the renovation of Ukrainian universities (2024), N. Vinnychuk (2024), O. Vintonyak (2024)

The national programmes are aimed at overcoming the immediate consequences of the war, such as relocating educational institutions, adapting to new conditions, and maintaining the continuity of the educational process. The key priorities are the physical restoration of destroyed facilities, ensuring the financial stability of higher education institutions and the introduction of modern technologies.

These initiatives are mostly short-term but lay the groundwork for further modernisation.

International aid is aimed at the long-term perspective, including support for research, development of innovations, and promotion of the inclusion of Ukrainian education in the global educational space. The areas of support, such as access to innovation, infrastructure development,

and financial stability, reflect the strategic importance of education as a tool for the country's recovery and development. The problem of attracting teaching staff is one of the key obstacles to the functioning and development of higher education institutions in Ukraine during the war. The key factors that complicate the situation include lower salaries, massive departure of specialists abroad, and lack of proper support from the state.

The decline in the level of remuneration of teachers is a serious problem caused by the overall budget deficit and the redirection of resources to more urgent needs. In 2024, the salary of a university associate professor (19<sup>th</sup> tariff category) with an 11% supplement for university teachers is UAH 12,128.97, and that of a professor (20<sup>th</sup> tariff category) is UAH 12,909.30 (Higher education employee..., 2024; Job salaries according to..., 2024). Therewith, inflation was 10.4% in November 2024, 5.1% – in 2023, and 26.6% – in 2022 (Inflation index in..., n.d.). Although nominal salaries stay stable, the real purchasing power of teachers continues to decline, which drastically affects their motivation to work in the education sector. This situation reduces the attractiveness of academic careers, especially for young professionals, who are more likely to choose to work in the private sector or emigrate in search of better conditions.

The massive outflow of professionals abroad is a major challenge for the Ukrainian higher education system. Many teachers, especially those with high qualifications and foreign language skills, choose to move to the EU, Canada, or the United States, where higher salaries and better working conditions are offered (Ennerberg & Economou, 2021; Ingersoll *et al.*, 2021). This leads to a "brain drain" and a weakening of the human resource potential of Ukrainian universities, which face a shortage of qualified specialists. The situation is further exacerbated by the lack of adequate support from the state, including social guarantees and opportunities for professional development. In the context of the war, initiatives such as funding for internships abroad or professional development for teachers have become less accessible, weakening the competitiveness of Ukrainian HEIs in the international arena.

Changes in the structure of demand for specialities in Ukrainian higher education institutions reflect dynamic socio-economic changes caused by both internal and external factors. One of the key factors is the war, which has reshaped the labour market and created new priorities in the choice of professions needed to rebuild the country. A significant decline in demand is observed for majors related to tourism, hotel, and restaurant business, and other industries, which largely depend on the stability of the economic and political situation. At the same time, there is an increase in the popularity of specialities in information technology, cybersecurity, medicine, psychology, and engineering (Network and activity..., 2024). These trends meet both the needs of restoring critical infrastructure and developing the digital economy.

The redistribution of demand for specialities directly affects the economic performance of higher education

institutions: the growing popularity of technical and medical specialities can lead to increased investment in the material and technical base of universities, including the purchase of modern equipment, software, and laboratory facilities. For example, universities with strong technical facilities will be able to generate additional revenue by increasing the number of contract students in these areas. At the same time, low-demand majors often face funding cuts, which leads to staffing optimisation, reduced numbers of teachers, and even possible closure of faculties. These processes can negatively affect the diversification of HEIs' educational services and limit opportunities for students.

Restoration of the physical infrastructure of higher education institutions in Ukraine is one of the priority tasks in the post-war period. The extent of the damage caused by the hostilities includes destroyed academic buildings, dormitories, research centres, libraries, and sports complexes. As of November 2024, over 200 HEI facilities were severely damaged; 11 HEIs were completely destroyed (11 universities destroyed..., 2024). The scope of reconstruction includes major repairs, reconstruction, and construction of new facilities. For instance, at Taras Shevchenko National University of Kyiv, three academic buildings have been restored, including the Department of History of Ukrainian Literature, Literary Theory and Literary Creativity (Shevchenko National University..., 2023; Katayeva, 2023). At the National Technical University "Kharkiv Polytechnic Institute", it is planned to complete the reconstruction of the educational and laboratory building destroyed as a result of the armed aggression of the Russian Federation by the end of 2024 (Bykova, 2024).

Estimating the cost of reconstruction is an essential element of planning. Around USD 9.8 billion is required to fully rebuild the physical infrastructure of all Ukrainian education (World Bank, 2023). Part of the funding comes from the state budget, while international donors such as the EIB contribute with grants and loans. For example, under the Higher Education of Ukraine programme EIB has allocated EUR 120 million for the rehabilitation of universities using energy-efficient technologies (Over 13 million euros..., 2024).

The key challenges still lie in ensuring transparency of expenditures, promptness of project implementation, and prioritisation of funds among the affected regions. However, effective coordination between government agencies, universities, and international partners will facilitate the return of higher education institutions to full operation and their modernisation, which will increase the competitiveness of Ukrainian education on the global stage.

### **Models of higher education development in the postwar period and prospects for Ukraine's involvement in the European educational area**

Digitalisation and the introduction of innovative technologies have become priorities for the development of higher education institutions in Ukraine due to the COVID-19 pandemic and, subsequently, the full-scale invasion of

Russia. Under the current circumstances, this is not only a way to modernise the educational process, but also a necessity that meets the needs of the digital economy and the globalisation of the educational space. Digitalisation involves the development and implementation of electronic platforms that provide access to educational resources, regardless of where students live or their physical access to universities. This process is aimed at creating conditions for distance and blended learning, which has become particularly relevant in the context of war and post-war reconstruction. For instance, a national e-platform for distance learning with the ability to link to international educational resources and databases could be useful, which would improve the quality and competitiveness of Ukrainian education.

The introduction of innovative technologies in the educational process involves the use of tools such as virtual and augmented reality, simulation platforms, and intelligent learning systems (Aljawarneh, 2020). These technologies can increase the interactivity of learning, adapt the educational process to the individual needs of students, and create an environment for the development of creative and analytical skills. For example, the use of VR simulators in medical and technical specialities allows students to gain practical experience in conditions as close to real life as possible.

These priorities also help to improve the efficiency of managing educational institutions: by automating administrative processes, introducing electronic document management and quality monitoring systems, universities can greatly optimise their costs and improve the quality of educational services. The role of the private sector in the development of Ukrainian higher education institutions is becoming increasingly significant in the context of limited public resources and the need to modernise the education system. Public-private partnerships (PPPs) are a promising tool for attracting additional financial and organisational resources needed to restore, operate, and improve the competitiveness of Ukrainian universities.

PPPs can enable universities to attract private sector investment to finance infrastructure projects, such as the construction or renovation of academic buildings, dormitories, and research centres. For example, implementing projects involving private companies in energy-efficient

building retrofits could improve learning environments and considerably reduce universities' operating costs for utilities. The private sector can also play an active role in introducing modern educational programmes and technologies. Cooperation between universities and companies can help create innovative study programmes that meet the needs of the labour market. For instance, joint study programmes with IT companies, engineering, and medical corporations will enable students to acquire the practical skills needed to work in high-tech industries. Such partnerships can ensure that students are trained to meet the modern requirements of business and industry.

Furthermore, business can actively support the research activities of universities by funding research, creating grants and scholarships for students and teachers. For instance, the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" trains specialists in cooperation with Boeing-Ukraine, Samsung Electronics and others (Rector's report for the year 2019 on the implementation of Contract No. VI-44, 2019). Lviv Polytechnic National University actively cooperates with IT companies to create joint laboratories and training programmes in the field of digital technologies (How it's made, 2020; Lviv Polytechnic has..., 2021). A significant role in this is played by the interest of private companies in developing innovations that can be commercialised as innovative technologies or products. This creates a closer connection between science and business, which is a significant factor for the country's economic recovery.

Compliance with the Bologna Process standards in the context of recovery is a significant task for Ukrainian higher education institutions. The Bologna process involves the inclusion of national education systems in the European higher education area based on key principles: a three-tiered structure of education (Bachelor, Master, Doctor of Philosophy), the European Credit Transfer and Accumulation System (ECTS) and quality assurance. In the context of post-war recovery, Ukraine's HEIs may face challenges in meeting these standards due to the destruction of physical infrastructure, lack of resources and staff losses. However, the government and universities are taking active steps to maintain compliance with European requirements (Table 2).

**Table 2.** Best international standards and efforts to implement them by Ukrainian HEIs

Standard	Efforts
Restoring the three-tiered structure of education	Despite the challenges, universities continue to provide education at all three levels. Programmes are in place to support the academic mobility of students, such as Erasmus+, which enable them to complete their studies at partner European institutions and maintain the integration of the Ukrainian education system into the Bologna area
ECTS	Ukrainian higher education institutions support the functioning of ECTS as a basis for the recognition of qualifications and learning outcomes at the European level. Universities adapt their curricula to ECTS requirements, which allows students to freely continue their studies abroad and receive recognition of their diplomas

Table 2, Continued

Standard	Efforts
Ensuring the quality of education	One of the key elements of the Bologna Process is monitoring and improving the quality of education. As part of the post-war reconstruction, higher education institutions should actively cooperate with international accreditation agencies to confirm the quality of their programmes. For example, the National Technical University "Kharkiv Polytechnic Institute" was accredited according to European standards, confirmed by the National Agency for Quality Assurance in Higher Education, which helped to improve its reputation internationally

**Source:** created by the authors of this study based on Erasmus+ (2024), National Agency for Quality Assurance in Higher Education (2024)

Thus, compliance with the Bologna Process standards stays a strategic priority for the Ukrainian higher education system. Efforts to restore infrastructure, maintain academic mobility, and improve the quality of education ensure Ukraine's inclusion in the European educational space, even in the face of a demanding socio-economic situation. Another significant factor in this regard is the academic mobility of students and teachers, as it facilitates the exchange of knowledge, professional development, the introduction of innovative teaching methods, and the creation of international partnerships.

Student mobility allows higher education institutions to raise funds through participation in international educational programmes such as Erasmus+ (2024), German Academic Exchange Service (2024), and others (Nogueiro *et al.*, 2022). Thanks to these programmes, students get the opportunity to study at leading European universities, while Ukrainian universities strengthen their international reputation and increase the attractiveness of their study programmes. Apart from financial support, such programmes promote the implementation of new educational standards and technologies, which increases the competitiveness of Ukrainian universities.

The mobility of teachers is a factor in the development of human resources at universities: teachers who take part in exchange programmes or internships return with new knowledge, teaching methodologies and research experience. For instance, the Fulbright Ukraine (2024) and Horizon Europe (European Commission, 2024) programmes provide an opportunity for Ukrainian teachers to collaborate with foreign colleagues and introduce innovative approaches to the educational process, which improves the quality of educational services (Bettie, 2019; de Lama Sanchez *et al.*, 2023).

Establishing joint programmes with leading universities around the world opens new opportunities for Ukrainian higher education institutions in the field of international cooperation. Such programmes include double degrees, student and faculty exchanges, and joint research projects. At the same time, international cooperation can improve the economic efficiency of higher education institutions by attracting foreign students and grant programmes, which will enable universities to receive additional financial resources. It also helps to

improve the infrastructure and facilities necessary to provide high-quality educational services.

### Recommendations for improving the economic situation and management of higher education institutions

Challenges caused by the war, the economic crisis and reduced budget funding are forcing universities to introduce new financial mechanisms to ensure stability. One of the key areas is diversification of funding sources, as conventional dependence on the state budget can no longer be the only support for higher education institutions. According to F. Barrera-Osorio *et al.* (2022) and C.R. Teal *et al.* (2023), promising alternatives may include attracting private capital through public-private partnerships, grant programmes, international aid, and the development of educational services on a commercial basis.

Universities should implement energy-efficient technologies to reduce utility costs and optimise administrative processes through digitalisation. It is vital to consider the introduction of electronic document management and online learning platforms to reduce costs and increase the efficiency of management decisions. The development of additional educational services may allow universities to generate new sources of income. HEIs should create professional development programmes, professional trainings and certification courses that meet the current needs of the labour market. Emphasis should be placed on cooperation with the private sector to develop relevant curricula that will attract new categories of students (Pysarchuk, 2021).

Particular attention should be paid to the internationalisation of education. To increase financial sustainability, universities are encouraged to develop joint programmes with leading foreign universities, introduce English-language programmes and actively promote educational services in international markets. This will allow attracting foreign students, who are a crucial financial resource for higher education institutions. Thus, the financial sustainability strategy of higher education institutions should be based on diversification of funding, cost optimisation, development of additional educational services and internationalisation. Consistent implementation of these recommendations will enable Ukrainian universities to adapt to the challenges and create the basis for sustainable development in the long term (Table 3).

**Table 3.** Programmes (instruments) and timing of implementation of long-term planning and financing instruments

Programme (tool)	Description	Implementation plan	Stages of implementation	Timing of implementation
Long-term stability fund	Establishment of a trust fund to cover unforeseen expenses of higher education institutions in times of crisis.	Formation of the fund through government grants, private contributions and investments.	<ol style="list-style-type: none"> <li>1. Creation of the fund's regulations;</li> <li>2. Search for sources to fill up the fund;</li> <li>3. Introduction of mechanisms for transparent management of funds;</li> <li>4. Audit and reporting.</li> </ol>	2025-2026
Development of paid educational services	Expansion of the range of paid services, including certified courses, trainings, and professional development programmes.	Market demand analysis; development of new paid programmes; promotion of services among the target audience.	<ol style="list-style-type: none"> <li>1. Research of the market needs for additional educational services;</li> <li>2. Creation of training programmes;</li> <li>3. Marketing and advertising campaign;</li> <li>4. Monitoring of the effectiveness of programmes;</li> <li>5. Adjustments based on monitoring results and market needs.</li> </ol>	2025-2027
Attracting sponsorship contributions	Search for patrons and sponsors to support infrastructure projects and research initiatives.	Development of proposals for sponsors; conclusion of partnership agreements; reporting on project implementation.	<ol style="list-style-type: none"> <li>1. Formation of a database of potential sponsors;</li> <li>2. Preparation of individual proposals;</li> <li>3. Fundraising for concrete projects;</li> <li>4. Control of the targeted use of contributions.</li> </ol>	2025-2027
Expansion of international grants	Active participation in international grant programmes to finance research and infrastructure development.	Monitoring of grant opportunities; preparation of applications and participation in competitions.	<ol style="list-style-type: none"> <li>1. Analysis of available international grants;</li> <li>2. Formation of research and infrastructure projects;</li> <li>3. Preparation and submission of applications;</li> <li>4. Project implementation and reporting to grantors.</li> </ol>	2025-2029
Commercialisation of scientific developments	Implementation of mechanisms for commercialisation of scientific ideas, innovations and technologies of universities.	Creation of technology transfer centres; development of innovative solutions in partnership with business.	<ol style="list-style-type: none"> <li>1. Identification of promising scientific developments;</li> <li>2. Creation of innovation hubs;</li> <li>3. Cooperation with business to bring solutions to the market;</li> <li>4. Monetisation of scientific results.</li> </ol>	2025-2028

**Source:** created by the authors of this study

The timing of the programmes was determined based on the scope of work, availability of resources, and the strategic significance of the measures for the financial sustainability of higher education institutions. The period of 2025-2026 was chosen to create a long-term stability fund, as such measures require an immediate response and rapid formation of basic structures. The development of paid educational services is planned for the medium-term period of 2025-2027 due to the need for market research and gradual launch of programmes. It is recommended to introduce

sponsorships in 2025-2027, as the search for partners and the conclusion of agreements require time for preparation and negotiations. For the expansion of international grants, the period of 2025-2029 was chosen because of the lengthy procedures for monitoring opportunities, preparing applications, and implementing projects. The commercialisation of scientific developments also involves a lengthy period of 2025-2028 due to the complexity of the processes that include the creation of infrastructure, development of innovations, and their entry into the market.

## Discussion

The study examined in detail the economic potential of Ukraine's higher education system and assessed the factors that determine its further development in the post-war environment. The study examined possible ways to restore higher education institutions, financial support instruments from the state, the private sector, and international partners, as well as innovative solutions to ensure the stable operation of educational institutions in the face of uncertainty. The identified problems pointed to the need for a comprehensive approach to reforms to remedy the consequences of the destruction and lay the foundation for the growth of the entire education sector.

The study found that the war has drastically affected Ukraine's economic and educational sectors and has led to a substantial reduction in funding for higher education. Specifically, the reorientation of state resources to military needs has limited the funds available to support educational infrastructure and implement development programmes. This situation has made access to quality education more cumbersome, especially in regions affected by active hostilities. The consequences of the destruction were reflected in a decrease in the number of students able to continue their studies, as well as the need to introduce alternative funding models and attract international support. At the same time, the analysis revealed that the adaptation of educational programmes and a focus on recovery can only contribute to the stabilisation of the educational system and further overall economic growth of the country. K. Amone-P'Olak (2020) and T.K. Levi (2019) provided valuable context for understanding the challenges and opportunities facing Ukraine's higher education system. For example, K. Amone-P'Olak highlighted that investments in curricula and skills development have been an effective tool to overcome the effects of war in Uganda, which resonates with the situation in Ukraine, where curricula need to be adapted to current labour market needs, including specialities related to infrastructure reconstruction. T.K. Levi revealed the role of education in strengthening the resilience of society after the conflict in Sri Lanka. Analogously, in Ukraine, education can be an indispensable tool for building social cohesion, promoting the inclusion of internally displaced persons, and the return of young people to the education system. Engaging international partners and implementing inclusive education initiatives are critical to achieving these goals. Thus, education plays a leading role in post-war recovery and contributes to long-term economic development.

An analysis of available resources and strategies for restoring education reveals a complex system of interaction between government initiatives, private capital, and international funds. National policy aims to stabilise the financial base of universities, while government infrastructure rehabilitation programmes rely on a combination of budget support and sponsorship and grant funds (Hysi *et al.*, 2024). The presence of the private sector is not limited to one-off investments: economic actors offer technical

expertise, research cooperation, and the launch of innovative projects. International organisations can offer material resources, advisory support, management experience, transparent accreditation procedures, involvement in global educational initiatives, etc. This multi-level approach can provide the ability to respond to the dynamic challenges posed by the immediate aftermath of war, long-term labour market trends and demographic shifts. An approach that combines government projects, private partnerships, and long-term international programmes can help increase the resilience of the education system and create the preconditions for the modernisation of Ukrainian education

Comparison with the study by M. Buheji & B. Buheji (2024) revealed comparable challenges in the context of the Gaza Strip, where education has become a component of a comprehensive system of social and psychological rehabilitation of the affected civilian population, including children. Ukrainian initiatives and Gaza's experience are identical in their efforts to support and develop education, preventing the destructive effects of war on the formation of future generations. Analogous parallels can be traced in the analysis of medical education during armed conflict in V.A. Dobiesz *et al.* (2022). The experience of creating flexible learning models and implementing adaptive approaches in crisis circumstances confirms the significance of diversified tools for educational development. In a context where infrastructure is being destroyed and communities are under intense psychological pressure, the medical field, as well as higher education overall, needs solutions that can guarantee the continuity of professional training. This experience is in line with the logic of Ukrainian initiatives focused on flexibility, diversity of resources, and international practices. This approach confirms the ability of modern education systems not to stop at overcoming the immediate consequences of the crisis, but to reorient themselves to strategic tasks related to training specialists for societies seeking stability and further development.

From an infrastructural and organisational standpoint, the problem of the destruction of educational institutions extends beyond physical losses and includes the preservation of intellectual potential, the restoration of management systems and the updating of specialised curricula in response to new conditions (Tarasenko, 2023). Finding adequate solutions requires an awareness that returning to previous standards is not enough, as the restoration process is not limited to replacing destroyed walls or purchasing technical equipment. This refers to creating a dynamic environment capable of adapting to the changing demands of the labour market, integrating innovative approaches to the educational process and establishing sustainable interaction between academic, business and international circles. Such a restructuring requires effective mechanisms for attracting funding, developing project strategies, and introducing alternative educational formats aimed at long-term sustainability and competitiveness of education. H. Moodrick-Even Khen (2023) examined the long-term effects of school destruction, disruption of

education, and the creation of unsafe conditions and found that the restoration of education is critical to ensuring the sustainable development of society in war and post-war. R.L. Geiger (2019) also examined the post-war transformation of higher education in the United States as a historical example of successful adaptation to the new requirements of society. The mechanism of large-scale student engagement and reformatting of educational institutions demonstrated the system's ability to go beyond mere recovery and become a driver of social, economic, and technological growth. In comparison with these studies, the restoration of educational institutions after the war shocks involves not only overcoming the consequences of infrastructure destruction, but also the desire to create a qualitatively new educational reality that accommodates both the interests of the most vulnerable communities and the need for dynamic development of the educational space overall.

Innovative approaches to education in times of war are significant not just as a means of temporary adaptation, but as indicators of the ability of the education system to withstand radical external challenges: power outages, challenges with Internet access, inability to follow a clear schedule, etc. (Dmytrenko, 2024). Such an approach should go beyond the classical model of online lectures and seminars. Innovativeness should be manifested in the ability to build the learning process around the minimum available resources, to establish independent work, and to organise communities of practice. Comparison with the study by E.K. Agormedah *et al.* (2020) on the transition to online learning in Ghana during the COVID-19 pandemic revealed that the radical change in the conditions of the learning process under the pressure of emergency circumstances reveals deep inequalities and infrastructural limitations. In Ghana, the pandemic has exposed digital divides and a lack of adequate technical support. In a war, such problems are even more acute, as it is not just a matter of not having the right devices or access to the network, but also of having to work in a physically dangerous and psychologically challenging environment. In both cases, innovative approaches require long-term strategies that focus on system sustainability, human resource development, digital literacy, and flexible infrastructure.

The reasons for the outflow of teachers and researchers abroad pointed to problems in the financial sector, as well as the structure of educational institutions and research environments. Low salaries and limited career opportunities deter talent, but the uncertainty of long-term prospects and the lack of transparent management decisions are also significant. Working conditions, which are perceived as conservative and regulated by methodological templates of past decades, encourage professionals to look for a space where scientific ideas do not encounter bureaucratic barriers and intellectual activity is not hampered by the inertia of administrative structures (Teymurova *et al.*, 2024). The search for better prospects abroad becomes a logical choice when professional potential does not find proper recognition and opportunities for realisation in the Ukrainian

higher education system. M.E. Dulamă *et al.* (2019), and L.P. Symaco & M. Hayden (2024) pointed out that the crises of ideas and human resources are not unique to Ukraine. In Romania, during the period of the Second World War and the communist transition, political ideologies and ideas of the "right" content of education, according to M.E. Dulamă *et al.* influenced teaching approaches, creating an atmosphere where individual scientific initiative was partially supplanted by external ideological priorities. L.P. Symaco & M. Hayden noted that in Southeast Asia, education modernisation has faced the challenge of harmonising diverse national contexts, uneven accessibility and difficulties in adapting to global standards, which often hinder the dynamics of attracting and retaining qualified academic staff. In other words, the ability of education systems to retain and develop human resources depends on funding and on the ability of government and academic institutions to overcome inertia, remove unnecessary ideological or bureaucratic constraints, and build an environment conducive to creative growth (Grajcević & Shala, 2021). This ability determines whether education will become a truly modern environment, open to innovation and interested in supporting its teachers and researchers.

The reviewed studies agreed that strengthening the quality and accessibility of higher education requires strengthening the links between universities, research institutes, and the labour market, as well as creating mechanisms that support teachers and students in times of systemic change. Therewith, a series of issues that require further study persists, namely, strategic principles of infrastructure financing, flexible methods of managing universities in unstable economic conditions, and ways to integrate new digital tools that will improve the efficiency of the educational process even with limited resources.

## Conclusions

The economic situation of Ukraine's higher education system during the war was characterised by considerable underfunding, physical destruction of infrastructure, and a decrease in the number of students due to migration and internal displacement. The shift of state budget priorities to military needs drastically limited the ability of higher education institutions to maintain the quality of education, modernise infrastructure and develop research. At the same time, the destruction of university buildings and dormitories, especially in the regions of active hostilities, requires significant financial investments estimated at billions of dollars. It was estimated that the full physical restoration of the scientific and educational infrastructure could cost more than USD 9.8 billion, requiring both national and international resources.

Physical damage to the infrastructure has become one of the most serious challenges for Ukraine's higher education system: the hostilities have destroyed academic buildings, dormitories, and research centres. Without adequate access to physical facilities, universities were forced to switch to distance or hybrid learning, which, while

allowing for the continuation of the educational process, proved insufficient for practical classes and research.

The identified changes in the structure of demand for specialities also reflect the transformation of the country's socio-economic landscape. The decline in the popularity of majors in tourism, hospitality, and other industries dependent on economic stability contrasts with the growth in demand for technical, medical, and IT fields. This is in line with the new priorities of economic recovery, which include the development of critical infrastructure, digitalisation, and training in high-tech industries. Universities that can adapt to these changes can attract more students and funding.

The decline in human resources continues to be a substantial problem due to the massive outflow of teachers abroad and the decline in the real purchasing power of salaries. Despite the stability of nominal salaries, inflation has led to a sharp decline in their real value, which weakens the motivation of teachers to work in the higher education system. Additionally, the emigration of qualified professionals has exacerbated the problem of staff shortages, especially among younger teachers who choose to work abroad or in the private sector. It was found that the modernisation and digitalisation of the higher education system are significant factors for effective recovery in the post-war period. The development of hybrid learning

models, the introduction of digital platforms, and the use of innovative technologies will ensure continuous access to education and improve its quality. However, many universities face technical and financial constraints, which complicates their modernisation.

International aid plays a key role in the restoration and development of Ukraine's higher education system, helping to rebuild infrastructure, fund research, and support teaching staff, while public-private partnerships are a valuable tool for attracting investment and introducing innovations into the educational process. Further research should focus on the practical measurement of the effectiveness of funding and modernisation mechanisms in the post-war recovery. Continued study of this area will contribute to the formation of effective strategies for the sustainable development of higher education, which will help to overcome the shortage of human resources, increase the international competitiveness of universities and ensure the training of qualified specialists for the country's economic recovery.

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### Conflict of Interest

None.

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## Економічний стан та перспективи розвитку вищої освіти України в умовах повоєнного відновлення

Олег Куклін

Доктор економічних наук, професор  
Черкаський державний бізнес-коледж  
18000, вул. В'ячеслава Чорновола, 243, м. Черкаси, Україна  
<https://orcid.org/0000-0001-6904-3496>

**Анотація.** Метою статті стало дослідження фінансових аспектів функціонування вищої освіти України та пошук шляхів її відновлення у післявоєнний період. Було здійснено дослідження фінансового стану українських закладів вищої освіти, національних, приватних та міжнародних програм фінансування. У результаті проведеного дослідження було виявлено, що відновлення вищої освіти в Україні після війни безпосередньо пов'язане з ресурсами та стратегіями підтримки, що надходять із державних, приватних та міжнародних джерел. З'ясовано, що фізичне руйнування університетів не вичерпує масштабу проблеми: паралельно відбувається відтік викладацького складу через низькі зарплати й недостатні перспективи, а також поглиблюється криза управлінських моделей, неспроможних швидко реагувати на вимоги повоєнного періоду. Було зроблено висновок, що фінансова допомога та механізми залучення приватного капіталу здатні лише частково розв'язати нагальні питання, оскільки потрібні більш гнучкі формати навчання та системні зміни в організації навчального процесу. У зв'язку із цим було запропоновано розглядати інноваційні підходи в освіті як один із визначальних факторів стійкості, особливо коли йдеться про дистанційні та комбіновані формати навчання, які можуть допомогти подолати обмеження доступу до інфраструктури. Разом з тим, незалежно від джерела фінансування та форми залучення ресурсів, була виявлена необхідність збереження науково-педагогічного потенціалу, а також оновлення змісту програм з урахуванням викликів. У підсумку було сформовано рекомендації із сукупністю заходів, спрямованих на відновлення навчального середовища та його подальшого розвитку у повоєнний період. Отримані результати вказали на необхідність комплексного підходу до відновлення і модернізації вищої освіти України шляхом багатоканального фінансування, актуалізації навчальних програм та збереження науково-педагогічного потенціалу.

**Ключові слова:** державно-приватне партнерство; інновації; енергоефективність; джерела фінансування; відновлення інфраструктури