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SPORTS INFRASTRUCTURE IN UKRAINE DURING WAR AND POST-WAR RECONSTRUCTION: ANALYSIS, CHALLENGES, AND MODERNISATION MECHANISMS

СПОРТИВНА ІНФРАСТРУКТУРА УКРАЇНИ В УМОВАХ ВІЙНИ ТА ПІСЛЯВОЄННОЇ ВІДБУДОВИ: АНАЛІЗ, ВИКЛИКИ ТА МЕХАНІЗМИ МОДЕРНІЗАЦІЇ

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ABSTRACT

Purpose. This study aims to develop viable strategies for the revival and modernisation of Ukraine's sports infrastructure in the context of post-war reconstruction.

Methodology. A large amount of data was processed using methods of systematisation, comparative analysis and synthesis, including scientific publications, analytical reports (notably from the Kyiv School of Economics and the Ministry of Youth and Sports of Ukraine), as well as regulatory and legal documents. A comparative analysis of quantitative data on damage caused and qualitative assessments of systemic problems was conducted. Additionally, the results of expert studies conducted using the Delphi method were considered, enabling the identification of critical needs and priority areas for industry development.

Results. It was established that large-scale military aggression caused extensive destruction of the Ukrainian sports infrastructure, resulting in consequences that extend beyond material losses. The analysis shows that the war exacerbated and intensified systemic shortcomings that existed long before February 2022, particularly uneven development, an outdated material and technical base, and a lack of clear state policy. The loss of infrastructure has led to a decline in physical activity, the depletion of human resources and the mass migration of

Мета. Метою дослідження є обґрунтування життєздатних стратегій відродження та модернізації спортивної інфраструктури України в умовах післявоєнної відбудови.

Методологія. У дослідженні було застосовано методи систематизації, порівняльного аналізу та синтезу для опрацювання значного масиву даних, що включає наукові публікації, аналітичні звіти (зокрема, від Київської школи економіки, Міністерства молоді та спорту України), а також нормативно-правові документи. Застосовано порівняльний аналіз кількісних даних щодо завданих збитків та якісних оцінок системних проблем. Крім того, були враховані результати експертних досліджень за методом Дельфі, що дало змогу визначити найбільш критичні потреби та пріоритетні напрямки розвитку галузі.

Результати. Встановлено, що повномасштабна військова агресія спричинила значні руйнування спортивної інфраструктури України, завдавши багатогранних наслідків, які виходять за межі матеріальних втрат. Аналіз засвідчує, що війна створила нові проблеми, посилила та загострила системні недоліки, які існували задовго до лютого 2022 року, зокрема нерівномірний розвиток, застарілу матеріально-технічну базу та відсутність чіткої державної політики. Втрата інфраструктури призвела до спаду фізичної активності, виснаження кадрового

athletes and coaches. It has been demonstrated that rebuilding outdated facilities alone is insufficient and will only perpetuate existing issues.

Conclusions. A true revival of the sports industry requires a fundamental transformation that includes systemic reforms, the diversification of funding sources (through international aid, public-private partnerships, and private investment), and innovative approaches. This includes creating multifunctional, energy-efficient and inclusive facilities that meet society's modern needs. Investment in sport should be viewed as a strategic, long-term investment in human capital, psychological rehabilitation, and the restoration of national spirit.

Keywords: sports infrastructure, military aggression, restoration, modernisation, Ukraine.

потенціалу та масової міграції спортсменів і тренерів. Показано, що проста відбудова застарілих об'єктів є недостатньою й лише законсервує наявні проблеми.

Висновки. Справжнє відродження спортивної галузі потребує фундаментальної трансформації, що передбачає впровадження системних реформ, диверсифікацію фінансування через залучення міжнародної допомоги, державно-приватного партнерства, приватних інвестицій та інноваційних підходів. Це включає створення багатофункціональних, енергоефективних та інклюзивних об'єктів, які відповідають сучасним потребам суспільства. Інвестиції у спорт варто розглядати як стратегічні довгострокові вкладення в людський капітал, психологічну реабілітацію та відновлення національного духу.

Ключові слова: спортивна інфраструктура, військова агресія, відновлення, модернізація, Україна.

INTRODUCTION

Russia's full-scale invasion of Ukraine, which began in February 2022, has caused widespread destruction to the country's civilian infrastructure, with sports facilities being among the hardest hit. This destruction has caused significant economic losses and has also had a profound effect on the social fabric, the physical and psychological well-being of the population, and the nation's future sporting potential. The cultural sphere, including physical culture and sport, has suffered the greatest losses in Ukraine's history as an independent nation. The widespread impact has led to the closure or significant reduction in operations of most sports facilities, resulting in millions of residents losing access to, or having limited access to, relevant services.

This article summarises the important contributions of Ukrainian scientists and analytical institutions in assessing the damage to sports infrastructure between 2022 and 2025, and in developing viable strategies for its revival and modernisation. It describes the problems identified in detail, quantifies the damage where possible and develops recommended recovery paths, emphasising the scientific rigour and practical implications of the work. The main focus is, therefore, on analysing the challenges and justifying the mechanisms of transformation that will not only restore what has been lost, but also create modern, sustainable and inclusive sports infrastructure.

RESULTS

– Analysis of the impact of military aggression on the Ukrainian sports infrastructure

Russia's full-scale invasion of Ukraine in February 2022 caused widespread damage to civilian infrastructure, with sports facilities being among the hardest hit. This destruction has caused significant economic losses, and has also had a profound effect on the social fabric, public health and future sporting potential of the nation.

As Prykhodko et al. (2024) note, the cultural sphere, including physical culture and sports, has suffered the greatest historical damage. Goryunov et al. (2025) point out that such a

large-scale impact has led to the closure or significant reduction in the work of most cultural and sports institutions. As a result, millions of residents have lost access to, or have limited access to services.

Quantitative estimates of direct damage to Ukraine's sports infrastructure vary depending on the source, reflecting the difficulty of conducting a comprehensive assessment amid ongoing hostilities. According to a comprehensive report by the Kyiv School of Economics (KSE), 343 sports facilities had been damaged or destroyed as of early 2024, with total direct losses estimated at \$0.7 billion in U. S. dollars (Kyiv School of Economics, 2024).

However, a report by the Ukrainian Ministry of Youth and Sports presented at the EPAS meeting in May 2025 stated that 734 facilities had been damaged or completely destroyed, including 18 national Olympic and Paralympic training bases. The ministry estimated total infrastructure losses to exceed \$374 million in U. S. dollars (Ministry of Youth and Sports of Ukraine, 2025). It is important to note that KSE reports only consider the financial aspect, making it impossible to adequately evaluate intangible losses, such as the historical and cultural value of artefacts. This means that the actual cost of restoration, including renovation, will be significantly higher than current financial estimates suggest.

The impact of the destruction of sports infrastructure resulting from Russia's military aggression is widespread in Ukraine. Damaged or completely destroyed facilities have been recorded in as many as 14 regions of the country. A particularly high concentration of damage has been observed in the Donbas and Kharkiv regions, which is directly related to intense combat operations. According to the Donetsk Regional State Administration (2023), 74 sports facilities were damaged or destroyed in the Donetsk region alone.

Mariupol was particularly badly affected, with the enemy destroying the recently renovated Neptune swimming pool and other iconic complexes. The Volnovakha district, where the stadium was destroyed, and Bakhmut, which has been reduced to rubble, have also been severely affected. The Liman Arena and Altair Ice Arena in Druzhkivka were also seriously damaged.

As the largest city near the front line, Kharkiv's sports infrastructure suffered particularly extensive damage. The Sports Palace and Ice Arena, the city's largest indoor sports facility, were almost completely destroyed. Other damaged sites include the Unifight stadium and training complex of V. N. Karazin Kharkiv National University; the sports complex of the National Technical University Kharkiv Polytechnic Institute; the KhAI sports complex of the National Aerospace University named after M. E. Zhukovsky; the Lokomotiv Sports Palace; the Dynamo Stadium; the training base of the Metalist 1925 club; the Saltivsky Led ice sports complex; the Aquarena Olympic Sports Centre; and the Korotych sports aerodrome. This list is not exhaustive, and only reflects part of the losses suffered by the Ukrainian sports industry as a result of armed aggression.

In addition to direct destruction, the analysis shows that the war did not create all of Ukraine's sports infrastructure problems, but rather significantly exacerbated them, and exposed long-standing systemic shortcomings. Research by Imas et al. (2022) found that sports infrastructure facilities in Ukraine, and in Kyiv in particular, were developed unevenly in urban and rural areas. Despite the significant total number of sports facilities in Ukraine (96,678), many do not meet international standards, and have outdated material and technical resources. The level of service provision also does not meet

modern requirements. Furthermore, the authors note that the information in the Unified Electronic All-Ukrainian Register of Sports Facilities has not been updated, reducing management efficiency.

The analysis by Chub & Kreizer (2023) also confirms that many Soviet-era stadiums had exhausted their depreciation resources, and that the state lacked a clear development and planning strategy. The researchers examine the fundamental pre-war issues that led to the vulnerability and poor state of many sports facilities. They emphasise that not only did numerous Soviet-era stadiums “exhaust their depreciation capacity”, they were also characterised by an “unattractive appearance and low capacity”.

The study reveals a critical “lack of a clear state policy for the development of sport” and “a lack of a clear strategy for the development and planning of the construction and reconstruction of multifunctional stadiums” at both the national and regional levels. Sobko et al. (2025) consistently emphasise that systemic problems such as limited and uneven access to services, the gradual deterioration of the technical condition of sports facilities due to years of underfunding, and the lack of clear investment priorities and criteria existed long before the full-scale invasion.

Researchers Nikolaychuk et al., (2024) emphasise the need to create an environment focused on professional athletes, highlighting the current problems with sports facilities in the country. Additionally, Dariychuk, et al. (2025) identified several other issues, including economic inefficiency, high energy consumption and the failure of many facilities to meet modern environmental standards. Belenyuk (2023) also pointed out that many facilities are not adapted for people with disabilities, limiting inclusivity.

The loss of sports infrastructure has consequences that extend far beyond financial losses. It has a serious impact on public health, mental well-being, social cohesion, and the development of sporting talent. Millions of Ukrainians have lost access to, or now have limited access to basic services, which has led to a decline in physical activity (Andrienko et al., 2025). The war has also depleted human resources and caused the mass migration of athletes and coaches, which jeopardises the future of national teams (Belenyuk, 2023). A three-round study by Kuvaldina, et al. (2024) using the Delphi method confirms that the most urgent needs are to provide safe training venues, develop a logistics base for sports organisations and modernise equipment.

Therefore, the analysis shows that renovating sports facilities to pre-war standards alone will not suffice and will merely perpetuate existing issues. A true revival of the sports industry requires a fundamental transformation to eliminate the consequences of decades of underfunding and neglect, which goes beyond merely repairing war damage.

– **Proposed ways to revive and modernise sports infrastructure**

To effectively revive and modernise sports infrastructure in Ukraine – which is of paramount importance in the context of post-war reconstruction – systemic reforms, transparent auditing and a substantial update of the regulatory framework are essential. The existing problems, exacerbated by military aggression, require comprehensive, not isolated transformational changes aimed at overcoming the systemic shortcomings that existed before the war and the urgent needs caused by the aggression.

The fundamental principle of the proposed recovery strategies is the implementation of systemic reforms to overcome the aforementioned issues. Sobko et al. (2025) strongly advocate “systemic reform of sports infrastructure through national and local initiatives”. They propose conducting a “nationwide audit” of sports infrastructure to develop “an up-to-date information base for informed management decisions”. They also call for the

creation of a “single register of sports facilities with an assessment of their technical condition”, which would ensure transparency and efficiency in future planning by eliminating the problem of outdated data. Although the register exists (<https://sportsporudy.mms.gov.ua/>), it lacks up-to-date information about the condition of the structures.

The urgency of updating the regulatory framework is emphasised in the context of reconstruction. Chub & Kreizer (2023) observe that the last substantial update to domestic regulations occurred in 2010, and advocate for a comprehensive review to align them with contemporary international standards. This process is a prerequisite for implementing comprehensive strategic recovery programmes. Tsos (2023) and Tykhonchuk et al. (2024) emphasise the importance of the recovery of physical culture and sports at the level of rural communities in this process.

Additionally, national programmes such as the “*Development of Culture and Sports Systems*” initiative exist, incorporating the “*Programme of the President of Ukraine: Reconstruction of 18 Sports Boarding Schools and 100 Children and Youth Sports School project*” (Recovery of Ukraine, n.d.).

One of the main strategic foundations is the Concept of the State Targeted Social Programme for the Development of Physical Culture and Sports for the Period until 2030 (Cabinet of Ministers of Ukraine, 2025). This document is crucial for long-term planning and establishes the general direction of the industry’s development. However, as noted by Beleniuk (2023), the implementation of such policy documents has effectively halted or slowed down significantly. This highlights the need to introduce adaptive management approaches that allow for flexibility and enable the system to respond quickly to changing conditions Hrynchenko et al. (2025a). Such strategies should aim to respond quickly to current needs, allow for flexible planning, and prioritise investments.

In this context, the draft *Law of Ukraine ‘On Amendments to the Law of Ukraine ‘On Physical Culture and Sport’ Regarding Adaptive Sports’* (Verkhovna Rada of Ukraine, 2023) occupies a special place. This initiative is an important step towards creating an inclusive sports environment and expanding opportunities for people with disabilities, reflecting a strategic focus on social integration and rehabilitation through sport. Additionally, the digitisation of public administration in the field of physical culture and sport is a modern trend that can significantly enhance efficiency and transparency (Shchokin & Belenyuk, 2022).

Introducing electronic registers of sports facilities containing up-to-date information, alongside digital platforms for managing financial flows, will facilitate better planning, monitoring, and control. Therefore, successfully reviving sports infrastructure requires a comprehensive combination of fundamental reforms focused on transparency and compliance with modern standards, as well as flexible, adaptive strategic initiatives.

The effective restoration and modernisation of the Ukrainian sports infrastructure following large-scale destruction requires the development of reliable financial mechanisms and active investment. Decades of underfunding and neglect, exacerbated by the enormous losses incurred during the war, necessitate radically new approaches to accumulating, and effectively using funds. Budget funds at various levels, as well as extra-budgetary revenues, traditionally play a key role in financing. However, Michuda et al. (2023) argue that the current regulatory and legal framework for financing must be thoroughly reviewed and aligned with the realities of the war and post-war periods.

To significantly accelerate the reconstruction and modernisation process, it is crucial to attract additional funding sources. As well as state and international aid, Chub & Kreizer (2023) advocate a strategic transition towards reducing dependence on state funding and promoting greater commercial independence for sports complexes. They propose reliable business planning and marketing strategies as key tools for achieving this. International financial assistance is one of the most important additional sources of funding, particularly foreign grants, and loans from international financial organisations (IFOs), as well as special-purpose funds created by partner countries.

Public-private partnerships are equally important, as their models allow private sector funds to be attracted for the construction, reconstruction and operation of sports facilities. Furthermore, private investment and patronage should be stimulated through tax incentives, simplified licensing procedures, and clear investment guarantees. In the long term, recovery and reparations funds formed from the aggressor's confiscated assets could become a significant source of financing. The effectiveness of these mechanisms depends on transparent financial flows, strict controls, and modern project monitoring systems.

The restoration of sports infrastructure in Ukraine must encompass more than just rebuilding what has been destroyed. It is a unique opportunity to modernise the infrastructure and introduce innovative approaches, creating multifunctional, energy-efficient, inclusive facilities that will be sustainable in the long term. Ukrainian researchers consistently advocate a forward-looking approach to reconstruction. Sobko et al. (2025), for example, explicitly recommend the creation of "energy-efficient, inclusive and multifunctional facilities". They emphasise that such "versatile, transformable" facilities are an economically sound solution, particularly in view of limited funding.

Chub & Kreizer (2023) also highlight the multifunctionality of stadiums as a pragmatic way to increase their efficiency. Another key aspect is energy efficiency and long-term environmental sustainability. The introduction of "green" technologies, as discussed by Nikolaychuk et al. (2024), will reduce environmental impact, and ensure the long-term sustainability of facilities by addressing high energy consumption. In addition, special attention must be paid to inclusiveness and accessibility.

In the light of the increasing number of people with disabilities resulting from military action, ensuring universal design and barrier-free access for all is not only a requirement, but a priority (Belenyuk, 2023). The draft *Law of Ukraine "On Amendments to the Law of Ukraine 'On Physical Culture and Sport' Regarding Adaptive Sports"* (Verkhovna Rada of Ukraine, 2023) demonstrates the state's recognition of this necessity. Equipping sports facilities with modern equipment and technologies is crucial for improving the quality of training and ensuring visitor safety.

The conclusion of the Delphi study (Kuvaldina et al., 2024) emphasises the need to 'equip sports facilities with modern equipment and inventory', and further confirms the widespread call for modernisation and technological progress. In the context of ongoing threats, the safety of sports facilities must be considered from the design stage onwards. This includes creating protective structures (shelters), warning systems, and modern fire protection systems in response to outdated infrastructure and security risks.

In Ukraine's post-war recovery context, sport is becoming important not only as a means of physical development, but also as a powerful tool for social integration, psychological rehabilitation, and supporting human capital (Tykhonchuk et al. 2024). The large-scale

destruction of infrastructure and deep social trauma caused by military aggression require a holistic approach in which sport plays a pivotal role in restoring social well-being.

Participation in sporting events effectively overcomes the effects of stress, anxiety and post-traumatic stress disorder (PTSD), which are widespread among the population, particularly among veterans and individuals affected by war. The implementation of a pilot project by the Cabinet of Ministers of Ukraine (Cabinet of Ministers of Ukraine, 2025), which aims to support combatants and individuals with disabilities in participating in physical culture and sports, emphasises this role and demonstrates the state's recognition of the therapeutic value of sport.

Additionally, Sobko et al. (2025) view investment in sports infrastructure as a “long-term investment in human capital”, anticipating a substantial return – up to \$4.30 in U. S. dollars for every dollar invested – for society due to reduced healthcare costs and increased labour productivity. According to Belenyuk (2023), sports achievements and the successful hosting of sporting events can serve as powerful tools for restoring national spirit, enhancing a country's prestige on the international stage, and shaping a positive image as a strong and indomitable state. Therefore, investing in sports infrastructure is not just about rebuilding material objects. It is also a strategic investment in restoring public health, social cohesion, and human potential.

DISCUSSION

The discussion on the restoration of the Ukrainian sports infrastructure focuses not only on technical and financial issues, but also on rethinking the role of physical culture and sports in society. Preliminary analysis has revealed that, despite its destructive nature, Russia's military aggression has acted as a catalyst by exposing and exacerbating long-standing systemic issues in the sector: a lack of strategic planning, an outdated regulatory framework, and an uneven distribution of resources. Therefore, true revival cannot be reduced to simple reconstruction, but requires a fundamental transformation.

Comparing the quantitative damage estimates from various sources (Kyiv School of Economics and the Ministry of Youth and Sports) reveals significant discrepancies, highlighting the absence of a unified accounting methodology. This is a key limitation for the development of accurate recovery strategies. An important issue arising from this discrepancy is the inability to adequately calculate intangible losses – the historical, cultural, and social value of objects. Financial reports only reflect material damage, whereas the true cost of full recovery, including restoration, will be significantly higher. This creates an opportunity for further research aimed at developing comprehensive methodologies that consider not only the economic, but also the socio-cultural value of sports facilities.

The proposed systemic reforms, such as fulfilling the register and updating the regulatory framework, are crucial prerequisites for effective financing. These reforms address the issues of obsolescence and opacity identified by Imas et al. (2022). However, implementing these initiatives in the context of the ongoing war is a matter of debate. As mentioned by Hrynchenko et al. (2025a, 2025b), adaptive management approaches that ensure flexibility can play an important role here.

Additionally, the discussion focuses on rethinking the approach to investment, shifting the perspective from viewing sports infrastructure as a source of expenditure to viewing it as a long-term investment in human capital. Sobko et al. (2025) consider such investments to be “long-term investments in human capital”, and their significant socio-economic return is confirmed. This approach provides a basis for attracting not only

budgetary, but also private, investments, as well as international aid. Future research could focus on developing specific business models and public–private partnership mechanisms adapted to Ukrainian realities.

The integration of inclusive, energy-efficient and multifunctional solutions (Nikolaichuk et al., 2024; Dariychuk et al., 2025; Palchuk, 2025) is not just a result of current trends. Rather, it is a direct response to pressing needs, ranging from the growing number of people with disabilities resulting from military aggression, to the requirement for environmentally stable and economically efficient facilities. However, the question remains as to whether this modernisation will be sufficient to meet the needs of all segments of the population or if it will lead to greater commercialisation, which could restrict access for low-income groups.

Therefore, the main conclusion of the discussion is that the revival of the Ukrainian sports sector requires systematic modernisation, not just renovation. This should not only eliminate the consequences of the war, but also create a new, sustainable and inclusive ecosystem that meets 21st century requirements, and serves as a powerful tool for restoring national spirit and social cohesion.

CONCLUSIONS

The analysis shows that Russia's large-scale military aggression has caused extensive and unprecedented damage to the Ukrainian sports infrastructure, with losses extending far beyond the material. The quantitative estimates of this destruction vary depending on the source, reflecting the difficulty of maintaining accurate records amid ongoing hostilities. Nevertheless, it is evident that hundreds of facilities have been impacted, including vital national sports bases, despite the discrepancies in the figures. The key conclusion is that military aggression has not so much created new problems as catalysed and exposed systemic shortcomings that existed prior to February, 2022. These include uneven infrastructure development between urban and rural areas, the presence of outdated material and technical facilities at many sites, a lack of clear state policy, and inefficient existing registries.

In these circumstances, reviving the Ukrainian sports industry requires more than just rebuilding what has been destroyed; it requires fundamental transformation. This can be achieved through the implementation of comprehensive systemic reforms, including a nationwide audit of sports infrastructure, the creation of a single, up-to-date register and updating the regulatory framework in line with modern international standards.

Fundamental to this is diversifying funding by attracting not only budget funds, but also international aid, private investment, and public–private partnership mechanisms. Modernisation must be innovative, and aimed at creating multifunctional, energy-efficient, and inclusive facilities that can meet the needs of different population groups, especially people with disabilities, whose numbers have increased as a result of the war.

Therefore, the restoration of sports infrastructure should be considered a strategic priority in the post-war development of Ukraine. This would not only be an investment in the physical health and sporting potential of the nation, but also a powerful tool for psychological rehabilitation, social integration, and restoring national pride. A successful revival of the sports sector would contribute to a positive international image of Ukraine and be an important factor in restoring social well-being

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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