Resilient Minds

The unseen struggles of scientists in wartime Ukraine

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SHORT SUMMARY

Empowering scientists for a robust science ecosystem and sustainable recovery in Ukraine

The impact of war on Ukraine's science ecosystem has been understudied and underestimated. This report seeks to change that, highlighting the situation of scientists.

The overall landscape is daunting. Since 2014, more than 40 higher education or scientific research institutions have relocated, while 29.4% of all research institutions in Ukraine have suffered physical damage. Scientists have been deeply affected. Between 10% and 20% of scientific researchers have left their places of residence and work, seeking refuge within Ukraine or abroad, and 54.3% report being unable to conduct research at the same level as before the war.

This study highlights challenges and issues to be considered, such as job security for female scientists who have relocated abroad with their children, and for young scientists, and the facilitation of the return of researchers to Ukraine. Its findings draw on legislative and policy frameworks, available research and data, and insights from focus group discussions with Ukrainian scientists in December 2023 and January 2024.

Policymakers, researchers and their institutions and other stakeholders are invited to draw on these findings to empower Ukrainian scientists in order to enhance the resilience of the country's scientific ecosystem and create the conditions for sustainable recovery.

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"Since wars begin in the minds of men and women, it is in the minds of men and women that the defences of peace must be constructed"

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Resilient Minds

The unseen struggles of scientists in wartime Ukraine

Foreword

Since 2022, war has exposed all inhabitants of Ukraine to tremendous hardship. However, the burdens placed on scientists and more generally on the country's science and education ecosystem have been largely overlooked. War has diminished its human, financial, and material resources and aggravated existing challenges. The severity of the situation cannot be understated. Laying the foundations for successful rebuilding of Ukraine's scientific ecosystem necessitates a comprehensive understanding of the conditions faced by its scientists, university educational staff, scientific and research workers, and young researchers – in wartime and before it.

Even before the February 2022 invasion, there was a significant decline in the number of scientists in Ukraine and talented young people were being attracted to other careers. However, in the months after, around 10% of Ukraine's scientists were compelled to depart from their places of residence and work, seeking refuge in other regions within Ukraine, or abroad, primarily in the European Union, where they have secured employment opportunities in research or teaching positions. Many more scientists are currently internally displaced within Ukraine. 54.3% of scientists reported being unable to conduct research at the same level as before the war. This all took place in the context of the already existing need to completely relocate more than 40 higher education or scientific research institutions since 2014. According to one report, 29.4% of all research institutions in Ukraine have now suffered some form of physical damage.

Identifying and meeting the needs of scientists, particularly those working near frontline zones, is crucial. Those needs concern fundamental issues like personal safety and mental health, securing a home to live in, as well as employment opportunities and an enabling working environment with access to scientific infrastructure, equipment and intellectual resources. Scientists face also significant economic challenges. As much as 83.8% of researchers face some form of financial hardship, with at least 40% only having funds enough to buy basic necessities like food. Mobility for the purpose of attending professional events or engaging in academic programs abroad is an issue especially for men of conscription age.

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The international community is attempting to help. Aid to Ukrainian researchers and educators has included sheltering scientists, funding for the extension of existing research projects, participation in research programs, conferral of scholarships, and the introduction of national programs for Ukrainian researchers. This must continue and, ideally, increase.

This report has important policy implications. Among the proposed policy actions are: the gradual increase of the financial provision for scientific activities to enhance the quality of working conditions and scientific results, and augment the attractiveness of scientific careers, particularly for young scientists; the promotion of an inclusive research culture that enables participation irrespective of gender, sexual orientation, religion, disabilities, ethnic origin, or social background; the adoption of measures to ensure job security for female scientists who have been forced to relocate abroad with their children and also to facilitate the return of researchers to Ukraine and their subsequent professional reintegration.

To create a momentum for positive change, UNESCO elaborated together with Ukrainian authorities and other national and international stakeholders an Action Plan for Sciences in Ukraine. Science is indispensable to resilience and creating the conditions for sustainable recovery. Empowering Ukrainian scientists, creating an evidence-driven scientific ecosystem and strengthening coordination amongst international donors and partners are central pillars of the Action Plan. We should not wait for the end of the war before we begin rebuilding. We should start together now.

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Executive Summary

The present report aims to analyse the situation and problems faced by Ukrainian scientists, university educational staff, scientific workers and young researchers (with a general focus on scientists) in wartime between 2014 and September 2024. It takes into account not only the negative impact on the sector since the full-scale invasion by the Russian Federation in February 2022, but also pre-existing structural challenges and the additional burden placed on the sector since 2014, during which time parts of the science ecosystem have been affected by the temporary occupation of Crimea, Donetsk and Luhansk. The document identifies the main issues and challenges and advances proposals and considerations intended to improve the situation and well-being of scientists in Ukraine. The findings are based on prior publications, statistics and open data (both official and non-official), and legislation, as well as the results of a series of focus group discussions with Ukrainian scientists conducted in December 2023 and January 2024. It should be noted that these discussions mostly reflect personal ideas of their participants and should not be considered as representative.

The burden of war on science

The war has placed a burden on the Ukrainian science and education system since 2014 and the temporary occupation of the territory of the Autonomous Republic of Crimea and of parts of the Donetsk and Luhansk oblasts (regions). It has led to a decrease in the human, financial and material resources of the Ukrainian scientific system and has exacerbated its existing problems such as chronic underinvestment and a shortage of scientific staff.

Undertaking research on all critical aspects of the Ukrainian scientific ecosystem is now even more demanding. It necessitates the collaboration of highly qualified researchers who are motivated, capable of managing the stresses caused by the war and financially secure enough to dedicate sufficient time to the research without being distracted by the need to seek other sources of income.

Prior to February 2022, the Ukrainian science and education system was characterised by stagnation. The allocation of funds to this sector amounted to only 0.41% of Gross Domestic Product (GDP),[1] largely due to a broad perception that research expenditures are not investment. This stagnation can be attributed to several factors, including a frequently revised legal framework that requires further updating, implementation of relevant policies and legislation that is at times inconsistent and inefficient, as well as the need for clearer guidance by the Ukrainian authorities as regards research agendas and research applications.

Long-lasting and critical political, economic and social transformations have resulted in a need to improve financial support for scientific research, including strengthening connections between higher education institutions (HEIs) and scientific research activities. This includes the need to improve what have traditionally been low salaries for scientific researchers, and a lack of social benefits, in order to make scientific research careers more attractive to talented young people and reduce the impact of 'brain drain'.

From 1990 to 2015, there was a significant decline in the number of scientists in Ukraine, with the figure dropping from 313,079 to 63,864,[2] most of whom work in research institutes of the National Academy of Sciences of Ukraine (NAS of Ukraine) and sectoral academies of sciences. In the 2022-2023 academic year, there were only 572 dedicated 'pure' research positions across all of Ukraine's universities. While the representation of women was strong, with women accounting for 46.4% of Ukraine's working researchers in 2022, the war is undermining progress towards gender equality.

1 State Statistics Service of Ukraine, 2021, *R&D expenditure by types of work in 2010-2020*, (In Ukrainian.) https://www.ukrstat.gov.ua/operativ/operativ2021/ni/rik/vvndrvr_10_20ue.xlsx

2 State Statistics Service of Ukraine, 2023. *Scientific personnel and number of organisations*, (In Ukrainian.). https://ukrstat.gov.ua/operativ/operativ2005/ni/ind_rik/ind_u/2002.html

The most effective method for presenting the demographic profile of Ukrainian researchers is to divide them into the following groups:

a. residing abroad;
b. residing in the temporarily occupied territories of Ukraine;
c. remaining in their existing places of residence in territories under Ukrainian control, but in close proximity to the frontline;
d. remaining in their existing places of residence, in territories under Ukrainian control which are not in close proximity to the frontline;
e. internally displaced persons (IDPs) within Ukraine;
f. persons having changed their existing places of residence in territories under Ukrainian control, but who do not have the status of IDPs.

Relocated scientists

As of July 2022, approximately 10% of the NAS of Ukraine's scientists had been compelled to leave their places of residence and work, seeking refuge in other regions deemed to be safer within Ukraine or abroad. This has taken place in the context of the need to relocate HEIs,[3] resulting in the designation of approximately 22,000 scientists as IDPs. A significant proportion of these individuals have experienced the loss of employment opportunities.

Surveys have revealed that the majority of scientists, approximately 80%, have chosen to remain in Ukraine since February 2022. In contrast, a smaller proportion, estimated to be between 10% and 20%, have opted to relocate to other countries, primarily in the European Union (EU), where they have secured employment opportunities in research or teaching positions. In the current circumstances, the likelihood that these individuals will return to Ukraine remains low.

Furthermore, at present, there have been no official announcements from the government regarding plans to repatriate these scientists back to Ukraine. The needs of scientists, including IDPs, have been identified as crucial, particularly those working in close proximity to frontline zones. These needs encompass personal safety concerns, securing residence, employment opportunities, administrative support, social services, legal assistance and access to scientific infrastructure. The challenges faced by those displaced within the country include the absence of equipment and research resources, electricity supply at the workplace (or at home in the case of online work) and uninterrupted internet access. Those who had relocated abroad require financial aid, social support, places to live and employment.

Financial needs of scientists

Ukrainian scientists are facing significant economic challenges. According to research conducted by the UAScience.Reload,[4] an initiative launched in 2022 to raise awareness of the threats faced by Ukrainian scholars and to facilitate the provision of assistance to those who require it, 83.8% of respondents claimed that their financial situation worsened since the onset of the full-scale invasion. At least 40% of researchers reported only having enough funds to buy food, while 27.7% reported being able to afford food and clothes but faced difficulties buying items such as laboratory and office equipment. Despite these difficulties, 81.1% of researchers confirmed that they continued to receive their salaries, while 2.3% said that their wages were cut.

> *The exodus of researchers and institutions has resulted in the designation of approximately 22,000 scientists as internally displaced persons. A significant proportion of these individuals have experienced the loss of employment opportunities.*

These salary levels were already low: for years, in the period before 2022, State funding of science had been poor, notwithstanding the Article 48 of the Law of Ukraine "On Science and Scientific and Technical Activities". In 2019, for instance, the average salary of scientific researchers in the system of the NAS of Ukraine was lower when compared to the average salary in industry and in the entire national economy. In some regions of Ukraine, where the cost of living was higher, salaries were insufficient to meet basic expenses such as rental costs for homes and other daily family needs. This caused scientific researchers to move to other cities, or abroad, to look for employment in other higher education or research institutions, or for better-paid

3 The activities of the relocated higher educational institutions are regulated by the Law of Ukraine "On Amendments to Some Laws of Ukraine Regarding the Activities of Higher Education Institutions and Scientific Institutions Relocated from the Temporarily Occupied Territory and from Settlements on whose Territory the State Authorities Temporarily do not Exercise their Powers" of 03.11.2016 No.1731-VIII: https://zakon.rada.gov.ua/laws/show/1731-19#Text

4 More information can be accessed here: https://www.uascience-reload.org/. See also A. Lutsenko et al., 2023, The Results of The Survey on The Needs of Ukrainian Scientists (First Wave Report), Max Planck Institute for Innovation & Competition Research Paper No. 23-03. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4335098

positions in non-scientific fields. The full-scale invasion has exacerbated this problem.

Women with children often expressed a stronger need for support, especially concerning war-caused relocation and securing research-related employment abroad. Men with children are limited to seeking research-related jobs within Ukraine. This is caused by the current restrictions imposed by the application of martial law, which prohibits most Ukrainian men of conscription age and women liable for military service from travelling abroad (some exceptions apply).[5] The number of academic positions that allow remote working is limited and is unlikely to increase due to the fact that Ukraine is not a member of the EU. Institutions in the EU frequently prioritize candidates from within the Union for logistical reasons, such as simpler tax regulations, streamlined employment laws and easier integration into existing frameworks. The negative effects of this prioritization are compounded by the perception of additional administrative complexity when working with non-EU individuals, such as navigating visa requirements, work permits or international banking systems.

Professional challenges

According to UAScience.Reload (2022), 29.4% of all research institutions in Ukraine have suffered some form of physical damage because of the war.[6,7] This significantly complicates work processes for Ukrainian researchers. 54.3% of scientists reported being unable to conduct research at the same level as before the war. Another challenge is preserving museum, archival, library and scientific collections, as well as cultural and natural heritage objects in wartime.

Between 2014 and 2022, 31 Ukrainian universities (out of approximately 300 universities in total)[8] and 10 scientific research institutions have been forced to relocate to regions of Ukraine not under temporary occupation. The Institute of Mathematics and Applied Mechanics of the NAS of Ukraine was relocated twice. They continue to face difficulties in conducting day-to-day operations. Productivity is being adversely affected and, according to *Web of Science* data, the publishing activity of Ukrainian researchers has decreased by approximately 10% since 2022.

> *29.4% of all research institutions in Ukraine have suffered some form of physical damage because of the war.*

In the context of the prevailing martial law, for the male within the 18-60 age group, permission to leave Ukraine for the purpose of attending professional events or engaging in academic mobility programs is only partially regulated and granted to a limited number of male scientists, determined on a case-by-case basis.[9] This authorisation is subject to a protracted and meticulous approval process, characterised by substantial regulatory tasks (either via the *Shliakh* system[10] or based on an official invitation letter from the inviting academic partner).

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5 Information regarding the "Rules for crossing the border under martial law by certain categories of citizens" can be found here: https://wiki.legalaid.gov.ua/index.php/ (Правила перетину кордону в умовах воєнного стану окремими категоріями громадян: Виїзд за кордон чоловіків у віці від 18 до 60 років та жінок-військовозобов'язаних під час дії воєнного стану (Rules for crossing the border under martial law by certain categories of citizens: Departure abroad of men aged 18 to 60 years and female soldiers during martial law).

6 *Education under threat*, n. d. (In Ukrainian.). https://saveschools.in.ua/

7 O. Verba, O. Herasymchuk and P. Bohutskyi, 2023, Hero City: crippled by Russian attacks, Ukraine's science hotbed refuses to give up, *Science*, Vol. 382, No. 6398, pp. 1142-1144. https://www.science.org/content/article/hero-city-crippled-russian-attacks-ukraine-s-science-hotbed-refuses-give

8 State Statistics Service of Ukraine, 2024, *Higher and Professional Pre-Higher Education in Ukraine in 2023*, Table 2.1, (In Ukrainian.) https://ukrstat.gov.ua/operativ/operativ2021/osv/vush_osv/vfpo_Ukr_2023.xls. See also: https://mon.gov.ua/news/zakladi-fakhovoi-peredvishchoi-ta-vishchoi-osviti-zavershuyut-protses-timchasovogo-peremishchennya-do-bezpechnikh-regioniv-ukraini

9 V. Lugovyi et al., 2023, Transformation of higher education in Ukraine: Impact of the war and objectives for post-war recovery. European journal of education, Vol. 58, No.4, pp. 611-628; I. Kuchyn, K. Bielka, L. Lymar and L. Puljak, 2024, Academic performance, perceptions, and motivations of medical PhD students in Ukraine during wartime: a mixed methods study, BMC med educ., Vol. 24, No. 1., pp.1421; Cabinet of Ministers of Ukraine, 2015, Про особливості запровадження пілотного проекту з організації регулювання цін на лікарські засоби для лікування осіб з гіпертонічною хворобою, (Resolution No. 579-2015-п), https://zakon.rada.gov.ua/laws/show/579-2015-%D0%BF#Text; Ministry of Education and Science of Ukraine, n.d., Про перетин кордону працівниками закладів освіти під час дії правового режиму воєнного стану, https://vspu.edu.ua/content/vs/doc/d2.pdf; Cabinet of Ministers of Ukraine, 2023, Про затвердження Порядку бронювання військовозобов'язаних під час дії воєнного стану, (Resolution No. 76-2023-п), (In Ukrainian.) https://zakon.rada.gov.ua/laws/show/76-2023-%D0%BF#Text; and Ministry of Economy of Ukraine, 2022, Лист Міністерства економіки України щодо бронювання військовозобов'язаних, (Letter No. DG220031), (In Ukrainian.) https://ips.ligazakon.net/document/DG220031?an=164

10 State Service of Ukraine for Transport Safety, n.d., Ліцензування в системі «Шлях», (In Ukrainian.) https://old.dsbt.gov.ua/uk/novyna/licenzuvannya-v-systemi-shlyah; and State Service of Ukraine for Transport Safety, n.d, ШЛЯХ: Система оформлення дозволів для виїзду за кордон, (In Ukrainian.) https://shlyah.dsbt.gov.ua/.

Scientists must comply with a number of requirements including:

a. The mandatory possession of an official invitation letter from the inviting partner (research institute, university, academic conference organiser);

b. Formal employment as an academic at the foreign institution (although this is not always the case and is subject to the positions available within the institution at the time of employment, for example an engineer might qualify, even though they may not formally be an academic);

c. Possession of not only a scientific degree but also existing official employment in a Ukrainian research institute which must be the researcher's primary employment.

Whilst these provisions permit certain scholars to travel, the ultimate decision regarding the approval of such requests is determined by the border control authorities, who may still refuse to grant permission, thereby preventing the scholar's departure from Ukraine. Moreover, scientists may be granted special permission to leave Ukraine for a period of 30 days or less, although this is granted on a case-by-case basis and without a sufficiently transparent process.

Steps taken to support Ukrainian scientists

In March 2022, the Ukrainian Law "On Education" was amended to ensure the retention of research and educational positions, including academic staff at HEIs, during periods of martial law. The amendments guarantee that affected staff members maintain their positions, receive their average wages and have access to living accommodation, irrespective of their temporary relocation or current whereabouts.

The State has sought to support Ukrainian scientists through salary bonuses, scholarships, awards and grants, distributed under initiatives by presidential, parliamentary, governmental and local authorities, as well as the NAS of Ukraine. Despite these efforts, particularly evident during wartime reallocations of financial resources to defence and security, the extent of support and the number of beneficiaries remain limited, with only several hundred individuals benefiting annually.

Instances of faculty dismissals based on the inability of staff to conduct classes in person rather than remotely, delays in salary payments and instances of scientists and educators going on forced unpaid leave, among other things, have exacerbated the situation.

The international community is trying to fill some of these gaps. Aid to Ukrainian researchers and HEI faculty is provided at both the pan-European and national levels. It includes increases in funding for the extension of existing research projects, participation in research programs, conferral of scholarships and the introduction of national programs for Ukrainian researchers. Yet, learning about these opportunities is difficult, so the *#ScienceForUkraine* volunteer initiative was launched to make the process easier and more widely available. One of its primary activities is the sharing of a database that includes over two thousand opportunities for Ukrainian students and researchers.

Kherson Library, Kherson
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Key Issues for Consideration

- Gradually increase the financial provision for scientific activities from the State budget of Ukraine, in accordance with Article 48 of the Ukrainian Law "On Science and Scientific and Technical Activities", through a variety of channels (including both basic and grant funding for scientific institutions). This increased financial provision should particularly focus on improving the salaries of scientists, enhancing the quality of their working conditions and scientific results, and increasing the attractiveness of scientific careers, particularly for young scientists.
- Ensure that the obligations on the State deriving from Article 57-1 of the Ukrainian Law "On Education", as amended during the period of martial law, are complied with, thereby securing the positions of researchers and teachers. This means providing an inclusive research culture free from discrimination on the basis of gender, sexual orientation, religion, disabilities, ethnic origin or social background. The contracts of those female scientists who have been forced to relocate abroad with their children should be given special consideration to ensure job security that includes non-termination and offering the possibility of remote working for displaced workers during and after the war.
- Revise the normative regulation on preparing and defending Doctor of Philosophy and Doctor of Arts dissertations to consider the applicants' needs, in particular, eliminating excessive restrictions on the timeframe for preparing and defending dissertations and easing formal membership requirements for the dissertation defence committee.
- Create conditions to facilitate the return of researchers to Ukraine and their subsequent professional reintegration. For example, a candidate who is currently employed at a foreign academic institution should be given favourable consideration for a relevant position at a Ukrainian research institute or university, given their possession of valuable foreign academic experience.
- Identify advantageous employment solutions that are mutually beneficial to both Ukraine and to the EU. Such solutions should encompass the potential for the establishment of remote (non-residential) employment opportunities for scientists based in Ukraine. These opportunities should enable them to secure positions within foreign research and HEIs. Overcoming obstacles related to tax residency status in the EU is of considerable importance. Amendments to the current tax regime, which does not allow Ukrainian citizens who are not located in an EU country to work in the relevant institutions of EU Member States, would better facilitate the integration of Ukrainian researchers into the European research community.
- Expand international grant programs for Ukrainian scientific institutions and HEIs, with a view to enabling them to conduct research within Ukraine.
- Prioritise the applications of relocated scientific research institutes and universities in scientific competitions. Furthermore, it is essential to hold specific scientific competitions that focus on topics relevant to the needs of their respective territories of origin.
- Conduct a greater number of open grant competitions, with the participation of students and early career researchers.
- Develop a national strategy for raising awareness of the importance of science and enhancing its attractiveness as a career option for youth. Systematically conduct communication campaigns to popularise science at the national, regional and local levels, involving scientists and representatives of educational institutions. Establish a state agency dedicated to the promotion of scientific culture and citizen science, following the examples of other countries.[11]
- Consider the additional complexities and needs of the relocated scientific research institutions and universities in the State higher education and science development policies in terms of funding, requirements for research results and student-to-teacher ratio.

11 More information can be found here: https://www.cienciaviva.pt/en/

Ivano-Frankivsk Oil and Gas University, Ivano-Frankivsk
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Methodology

This analytical research was conducted by the Kunsht non-governmental organization (NGO), with the support of the United Nations Educational, Scientific and Cultural Organization (UNESCO). The principal objective was to examine the circumstances of, and difficulties encountered by, Ukrainian scientists in wartime. This report presents a synthesis of the research findings, identifying the primary challenges and proposing issues to be considered for enhancing the support provided to scientists in Ukraine.

The research underpinning this report was undertaken in two stages. The initial stage involved desk research and was focused on analysing the available information in scientific articles, analytical materials, normative legal acts, programs, strategies and other materials. It examined the conditions faced by researchers in the Ukrainian scientific system and identified the main problems and challenges they have endured since February 2022. It also included a review of measures introduced since then to support Ukrainian scientists. As a result, critical gaps, such as the working conditions of researchers, were identified.

The second stage focused on these gaps to better understand the challenges on the ground. Six focus groups, with a total of 58 participants, were conducted with Ukrainian researchers of different age groups, disciplines, locations and levels of expertise. These focus groups provided lived-experience evidence of the challenges faced. Specific issues to consider in order to improve existing support have been proposed. This report is a culmination of that work, and the recommendations proposed aim to improve the support for Ukraine's scientists – the people who will help drive a sustainable and effective recovery.

Additionally, as part of the peer-review process, the report was shared with the NAS of Ukraine. The report includes a number of references to information provided by the NAS of Ukraine during that process.

While conducting the research and preparing this report, the research team kept the following Sustainable Development Goals (SDGs) in mind:[12]

SDG 4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

SDG 16

Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.

SDG 17

Strengthen the means of implementation and revitalise the Global Partnership for Sustainable Development.

12 United Nations Department of Economic and Social Affairs, Sustainable Development Goals: https://sdgs.un.org/goals

1 The situation of the Ukrainian science ecosystem prior to the full-scale invasion

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Ukrainian researchers work in almost every field of scientific knowledge, but in some areas, such as natural sciences, Ukraine is particularly strong and globally competitive.[13] Ukrainian universities offer training in almost any current field of study. However, Ukrainian researchers face difficulties in maintaining these services due to the long-term effects of the war with the Russian Federation, as well as the longstanding and chronic issues within the Ukrainian scientific system itself. As science, research and innovation can play a crucial role in Ukraine's resilience and post-war recovery, it becomes all the more urgent to tackle them.

Available data shows that even before February 2022, the scientific system of Ukraine was already facing stagnation and a major crisis as a consequence of shrinking resources. In particular: in 1997, investment in science, research and innovation was 1.19% of GDP;[14] by 2010, it had dropped to 0.75%; by 2020 it dropped again to 0.41%;[15] and in 2022 it was 0.33% of GDP (€540 million by exchange rate).[16] The continuous reduction of funding for science occurred despite the explicit requirement in Ukrainian law that the State provides budget funding 'for scientific and scientific-technical activities in the amount of not less than 1.7 per cent of the gross domestic product of Ukraine'.[17] By comparison, funding for science in the EU

13 A. Lutsenko, P. Goldin and O. Zhukova 2024, The current shape of the Ukrainian scientific system and perspectives for its preservation under Russian aggression. Science at Risk! (In Ukrainian.)

14 Y. Bezvershenko and O. Kolezhuk, 2022, Transforming Ukraine's research and development to become a driving force of reconstruction. In Y. Gorodnichenko, I. Sologoub, and B. Weder di Mauro(eds.), Rebuilding Ukraine: Principles and Policies. CEPR Press, Paris and London, pp. 385-414, p. 387. https://cepr.org/system/files/publication-files/178114-paris_report_1_rebuilding_ukraine_principles_and_policies.pdf

15 State Statistics Service of Ukraine, 2021, R&D expenditure by types of work in 2010-2020, (In Ukrainian.) https://www.ukrstat.gov.ua/operativ/operativ2021/ni/rik/vvndrvr_10_20ue.xlsx

16 T.V. Pysarenko, T.K. Kvasha, L.A. Musina, V. M. Bohomazova, O.F. Paladchenko and I.V. Molchanova, 2023, Roadmap for the use of science, technology, innovation to achieve the Sustainable Development Goals: collective monograph. *UkrISTEI*,p. 13, (In Ukrainian.) https://doi.org/10.35668/978-966-479-135-6

17 Ukrainian Law "On Scientific and Scientific-Technical Activities" No. 848-VIII (2015). Art. 48.2. [In Ukrainian]. https://zakon.rada.gov.ua/laws/show/848-19#n706

grew from 2.08% to 2.22% of GDP between 2012 and 2022. The 2022 EU spending total was €352 billion and more than half of it came from the business sector.[18]

The decline in funding described above was closely related to structural problems in Ukraine's science ecosystem. According to UAReforms (an ad-hoc group of experts preparing analytical materials for post-war Ukraine recovery in different sectors), science development in Ukraine was seen to have been affected by the following factors:[19]

- Lack of clear allocation of responsibilities among the actors and institutions charged with implementing mid- to long-term government-approved strategies for developing the research and innovation sector and inconsistent implementation of those strategies;[20]
- Insufficient clarity of State guidance as regards the key directions of the research agenda and the solicitation of requested inputs;[21]
- Research and innovation funding are viewed as maintenance expenses instead of investment;[22]
- Science is viewed principally as one of many attributes of the modern State in the international community, rather than as a much needed driving force behind social and economic development;
- Insufficient government support to ensure the quality of research and innovation;
- Outdated support and management systems for the scientific and innovation sphere as a whole and especially for areas that require context-specific support and management;
- The notable increase in research imitation practices, cases of plagiarism, pseudoscience and academic misconduct, which have been the subject of legal and administrative measures seeking to address the problem;[23]
- Scarcity of incentives for businesses to invest in research and development;
- A relatively outdated and unstable legal framework governing science in Ukraine, consisting of both gaps and laws in tension or conflict.

> *The official average wage in 2021 in the research and development sector was 15,200 hryvnias (around €500 gross, €400 net) per month.*

The only government-level document addressing innovation is the "Strategy for the Development of the Innovative Activity Sphere for the Period up to 2030".[24] However, its implementation plan,[25] approved in 2021, lacked budgetary support for the proposed actions, undermining its credibility as a true policy instrument and limiting any potential impact on the sector. In 2023, the Ministry for Digital Transformation (MDT)

18 Eurostat,2023, *R&D Expenditure*, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=R%26D_expenditure&oldid=551418

19 V. Bakhrushin, Y. Bezvershenko, , M. Wynnyckyj, O. Kolezhuk, I. Koliushko, S. Oleksiuk, O. Panych, H. Tytysh, L. Hrynevych and N. Shulha, (n.d.) Education, Science, and Society, *UAReforms*, Part 3, (in English.)

20 This is discussed in more detail below.

21 For example, State-level priorities, as defined by the Law of Ukraine "On the Priority Areas of Development of Science and Technology" of 11.07.2001 No. 2623-III (last amended on 21.12.2023) (https://zakon.rada.gov.ua/laws/show/2623-14#Text), included all fields of science, social sciences, and humanities but never served as an effective tool for real priority-setting, as it was not supported by targeted financial instruments with additional funding. The 'State Order For Scientific and Technical Developments', implemented by the MESU, operated as a de facto bottom-up instrument until 2024, despite its name suggesting a top-down approach. The Ministry initiated legislative changes aimed at reforming the system, but their outcomes remain to be seen.

22 Additionally, for years the issue of the State funding of science and innovations has been viewed primarily as a State expense for maintenance of the scientific system and not as investment in national development. The funding of science from the State budget of Ukraine remains the main tool for supporting the activities of State scientific research institutions, for regulation of the development of priority areas of science and innovation, for ensuring the process of reproduction of new fundamental knowledge.

23 The Ministry of Education and Science of Ukraine and the National Agency of Higher Education Quality Assurance are responsible for ensuring the quality of education and scientific research and preventing violations of academic integrity (the Regulation on MES of Ukraine, approved by the Resolution of the Cabinet of Ministers of Ukraine of 16.11.2014 № 630 (last amendment of 17.05.2024): https://zakon.rada.gov.ua/laws/show/630-2014-%D0%BF#Text; see also the Statute of the National Agency of Higher Education Quality Assurance as approved by the Resolution of the Cabinet of Ministers of Ukraine of 15.04.2015 No. 244 (as amended by Resolution of the Cabinet of Ministers of Ukraine of 23.01.2024 No. 71: https://zakon.rada.gov.ua/laws/show/244-2015-%D0%BF#n15); and the Commission under the Presidium of the NAS of Ukraine for the protection of science, countering pseudoscience, and falsification of scientific research (Resolution of the Presidium of the NAS of Ukraine on the appointment, approval of the position and updated composition of the Commission under the Presidium of the National Academy of Sciences of Ukraine for the protection of science, combating pseudoscience and falsification of scientific research No. 162 of 31.05.2017: https://false-science.ucoz.ua/index/komisija_nanu/0-12).

24 Adopted by the Order of the Cabinet of Ministers of Ukraine of 10.07.2019 No. 526-p: https://zakon.rada.gov.ua/laws/show/526-2019-%D1%80#Text

25 Action Plan for 2021–2023, https://zakon.rada.gov.ua/laws/show/1687-2021-%D1%80#Text

of Ukraine along with the Ministry of Education and Science of Ukraine (MESU), presented the "National Win-Win Strategy", which reflected the draft of the new "Strategy for Innovation Activity", still to be adopted as an official document with concrete actions and commitments.

Notably, there is no equivalent government-level strategy for the science sector. While the MESU adopted the "Roadmap for the Integration of Ukraine's Scientific and Innovation System into the European Research Area in 2021"[26] and included a chapter dedicated to science in its "Strategic Action Plan by 2027",[27] these documents lack a cross-governmental framework that defines the roles of other ministries and allocates funds for implementation. One sector-specific policy, the development of research infrastructure, is addressed by "The Concept of the State Target Program for the Development of Research Infrastructures in Ukraine for the Period Until 2026".[28] However, this Concept has not progressed beyond the conceptual stage into actionable measures or funded instruments.

Additionally, research conducted by UAReforms also highlights:

- low levels of State and private funding for research and innovation;
- a decrease in the number of organisations and researchers specialising in technical sciences;
- the lack of involvement of science and scientists in implementing sustainable development policies;
- a decrease in the number of graduates with technological specialities.[29]

At least since the 1990s, the Ukrainian science sector has been losing human capital. Data from the State Statistics Service of Ukraine show that between 1990 and 2015, the number of researchers in the country decreased dramatically – from 313,079 to 63,864.[30] Other data show there were 133,700 researchers working in research and development in 2010,[31] 90,200 in 2015,[32] 51,400 in 2020,[33] 34,200 in 2021, and 35,700 in 2022.[34] These two sets of official statistical figures do not match and neither include the 108,500 university faculty members[35] who are considered scientists under Ukrainian law. That the available statistical information about research in Ukraine is inconsistent generates additional challenges in ascertaining an accurate picture of the scientific population.

> *Even before February 2022, the scientific system of Ukraine was already facing stagnation and a major crisis as a consequence of shrinking resources.*

Over the past three decades, Ukrainian science has experienced a 'brain drain'. This has affected many other economic sectors. A major issue is the low salary rates. The official average wage in 2021 in the research and development sector was 15,200 hryvnias (around €500 gross, €400 net) per month.[36] This is only 8% higher than the average wage in the Ukrainian economy overall.[37] This is not competitive and does not therefore attract either domestic or international scientists.

Early career researchers are at a significant disadvantage and may receive approximately 6,000 hryvnias (equivalent of approximately €160 net as of 2023) per month for a full-

26 Available at: https://mon.gov.ua/static-objects/mon/sites/1/rizne/2021/02/12/edp-nakaz.pdf

27 Available at: https://mon.gov.ua/en/the-strategic-action-plan-of-the-moes-by-2027

28 Adopted by the Order of the Cabinet of Ministers of Ukraine on April 14, 2021, № 322-p: https://zakon.rada.gov.ua/laws/show/322-2021-%D1%80#Text

29 T.V. Pysarenko, T.K. Kvashaet al.,2023,. op. cit. pp. 23, 31.

30 State Statistics Service of Ukraine,2023, *Scientific personnel and number of organisations*, (In Ukrainian.) https://ukrstat.gov.ua/operativ/operativ2005/ni/ind_rik/ind_u/2002.html

31 State Statistics Service of Ukraine,2023, *Scientific and innovative activities in Ukraine*, Table 1.1, (In Ukrainian). https://www.ukrstat.gov.ua/druk/publicat/kat_u/2021/zb/10/zb_Nauka_2020.pdf

32 Ibid.

33 Ibid.

34 T. V. Pysarenko, T.K. Kuranda, T.V. Havrys, N. Shved, . Yu., A.B. Osadcha, Y.S. Tytaevska, and O.V. Kovalenko, 2023, Scientific and scientific-technical activity in Ukraine in 2022, Scientific and analytical report. *UkrISTEI*, Fig. 2.3, (In Ukrainian.) https://mon.gov.ua/storage/app/media/nauka/2023/07/25/Nauk-analit.dopov.Naukova.ta.nauk-tekhn.diyaln.v.Ukr.2022-25.07.2023.pdf

35 State Statistics Service of Ukraine, 2023, *Higher and professional pre-higher education in Ukraine in 2022*, Table 2.17, (In Ukrainian,) https://www.ukrstat.gov.ua/operativ/operativ2021/osv/vush_osv/vfpo_Ukr_2022.xls

36 State Statistics Service of Ukraine, 2021, *Labour in Ukraine*, Table 4.8, (In Ukrainian.) https://ukrstat.gov.ua/druk/publicat/kat_u/2022/zb/08/zb_pr_ukr_2021.pdf

37 Ibid.

time job even though the law defines a minimum wage for these workers as being 16,900 hryvnias (equivalent of approximately €450 as of 2023) per month after taxes.[38] There were reports of transferring both junior and senior researchers from full-time to part-time employment due to a lack of funding to cover salaries even before the full-scale invasion by the Russian Federation.

In 2022, women accounted for 46.4% of the total number of researchers working in all sectors of scientific activity in Ukraine, in both the public and private sectors. The majority of scientists worked in the public sector – approximately 58.0% of the total, of which 49.2% were female researchers. The prevalence of women in the medical and health sciences was particularly pronounced, accounting for approximately 64% of the total number of researchers in this field. The Social Sciences also exhibited a high proportion of female researchers, with women accounting for 62.5% of the total. The Humanities and Arts also demonstrated a notable female presence, with women constituting 62% of the total number of researchers. In contrast, engineering and technology were sectors in which men were predominant.[39]

Further, since 2014 Ukrainian science had already been experiencing serious negative impacts from the temporary occupation of the Autonomous Republic of Crimea and parts of the Donetsk and Luhansk regions. This has resulted in the loss of access to research infrastructure, university campuses and research institutes in these regions, with the Black Sea research infrastructure being particularly affected, as access to the Crimean Peninsula meant that research in this area became almost impossible. Furthermore, many researchers relocated to territories controlled by Ukraine and thus became internally displaced, whilst others remained in the temporarily occupied territories after 2014 and ceased to operate within the Ukrainian legal framework.

38 The Ukrainian Law "On Scientific and Scientific-Technical Activities" No. 848-VIII (2015). Art. 36.2. (In Ukrainian.) https://zakon.rada.gov.ua/laws/show/848-19#n539

39 T.V. Pysarenko et. al., op. cit., pp.22-23, (in Ukrainian.)

2 The impact of the war and challenges for Ukrainian scientists

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Since the invasion by the Russian Federation on 24 February 2022, the Ukrainian scientific system has experienced a decrease in human, financial and material resources, exacerbating its existing problems.

Relocated scientists

The war is significantly impacting researchers. In addition to direct human losses caused by the war, meaning reduced capacity as a result of casualties[40] and changes within the profession due to scientists joining the armed forces of Ukraine, conservative estimates as of July 2022 suggest that around 10% of researchers from the NAS of Ukraine relocated to other regions of Ukraine or abroad.[41] Later expert estimates show that around 22,000 researchers, mostly women with children, may be internally displaced.[42] Some of them lost their jobs.[43]

A survey conducted among 1,800 respondents under the UAScience.Reload initiative (2022) shows that during the first four months after February 2022, a significant number of researchers (85.3%) chose to stay in Ukraine despite the war (including 38.1% who moved to other regions of Ukraine and became internally displaced).

40 A. Irwin, 2023, The fight to keep Ukrainian science alive through a year of war. *Nature*, Vol. 614, No. 7949, pp. 608-612. https://doi.org/10.1038/d41586-023-00508-0; National Research Foundation of Ukraine, 2023, *An open letter of the researchers of Ukraine and the diaspora*, (In Ukrainian.) https://nrfu.org.ua/news/vidkrytyj-lyst-naukovcziv-ukrayiny-ta-diaspory/; and American Association for the Advancement of Science (AAAS), 2022, Ukraine's mounting death toll includes a growing number of researchers. *Science Insider*, https://www.science.org/content/article/ukraine-s-mounting-death-toll-includes-growing-number-researchers

41 National Academy of Sciences of Ukraine, 2022, *The National Academy of Sciences of Ukraine continues executing its main tasks*, (In Ukrainian.) https://nas.gov.ua/UA/Messages/Pages/View.aspx?MessageID=9259

42 N. Gaind, 2022, How three Ukrainian scientists are surviving Russia's brutal war. *Nature*, Vol. 605, No.7910, pp. 414-416. https://doi.org/10.1038/d41586-022-01272-3

43 ISC and ALLEA, 2023, *2nd Conference on the Ukraine Crisis*, https://council.science/wp-content/uploads/2023/08/Ukraine_2nd-Conference_Report_2023.pdf

14.7% moved abroad.[44] Further research provides similar data, reporting that 10% to 20% of Ukrainian researchers have been abroad since the beginning of 2022. The MESU estimates that, since the beginning of the war, approximately 6,000 of all 60,000 researchers, or 10%, left Ukraine, mostly to Poland and Germany.[45] De Rassenfosse et al.[46] present evidence of an emigration rate of 18.9% among a sample of scientists surveyed in early 2023.

This 'brain drain' poses a significant long-term risk for the Ukrainian economy. Particularly concerning is the loss of talented young people and the means to nurture that talent. After 24 February 2022, around 600,000 students and pupils, together with 23,000 school teachers, left Ukraine.[47, 48]

It is expected that a proportion of researchers who have been awarded scholarships to foreign universities and research institutes due to the war may elect to prolong their stay in the same or other foreign institutions after the war, taking advantage of both access to cutting-edge scientific equipment and potential integration support. However, these specialised support programs for Ukrainian researchers are limited in time, resources and funding. So, Ukrainian researchers who plan to stay in their research positions in institutions and universities outside Ukraine beyond offered opportunities will have to enter the job market and compete with other international researchers once their temporary, war-dependent support ends. This procedure is complicated, has a lower chance of success and, at the same time, does not guarantee the opportunity to continue research in the field they are already working in.

> *A Polish study indicates that 40% of the researchers who have left Ukraine are in the early stages of their careers, and 30% are female researchers who live with their children and without their husbands.*
>
> *More than 34% of researchers who have moved continue to work for Ukrainian universities. Between 20% and 30% have been able to work for foreign institutions and 17% are currently unemployed.*[49]

In this context, there is currently no official public strategy that clearly outlines planned measures to keep existing researchers and to reintegrate those who return.

Moreover, for those researchers who are currently abroad but who have lost their jobs in Ukraine due to the war, the study found no existing support mechanisms to facilitate their reintegration.

Among the respondents of the UAScience.Reload survey (2022) who still lived in Ukraine, as of the beginning of the war, 53.7% of researchers were in the areas without active combat, 19.9% in Kyiv, 7% in regions which are or have been temporarily occupied and have been the subject of armed conflict, and 19.3% in cities or villages without active combat but within these regions.[50] This situation may be contributing to the interruption of numerous scientific initiatives in Ukraine.[51] One available estimate suggests that, in 2022, 169 research projects were interrupted: 'Challenges include connections between relocated team members, ruined infrastructure, and reduced research equipment. The primary need is financial aid to continue research'.[52] Conversely, with the liberation of territories and a decline in the number of attacks on Kyiv and other regions, there has been a reverse

44 A. Lutsenko, N. Harashchenko, L. Hladchenko, N. Korytnikova, R. Moskotina and O. Pravdyva, 2023, The Results of The Survey on The Needs of Ukrainian Scientists (First Wave Report), *Max Planck Institute for Innovation & Competition Research Paper No. 23-03*, https://ssrn.com/abstract=4335098

45 Y. Polishchuk, V. Moskvina, I. Degtyarova, M. Galat and L. Makaruk, 2022, Assessing The Needs of Ukrainian Scholars in Dangerous Circumstances, *Zenodo Working Paper* 6413145, https://zenodo.org/records/6413145

46 G. de Rassenfosse, T. Murovana and W.H. Uhlbach, 2023, The effects of war on Ukrainian research, *Humanities and Social Sciences Communications*, Vol. 10, No. 856, https://doi.org/10.1057/s41599-023-02346-x

47 Ukrinform, 2022, *More than 23 thousand teachers and more than 600 thousand students went abroad* (In Ukrainian.) https://www.ukrinform.ua/rubric-society/3475112-za-kordon-viihali-bils-ak-23-tisaci-vciteliv-ta-ponad-600-tisac-ucniv.html

48 O. Harmatiy, 2022, Ukrainian Scientists and Educators in Wartime, *American Scientist*, https://www.americanscientist.org/article/ukrainian-scientists-and-educators-in-wartime

49 ISC and ALLEA,2023, op. cit.,p. 34.

50 A. Lutsenkoet al., 2023, op. cit.

51 *See also*: V. Tyravsky, 2023, Foreign researchers are advising on how to support the science of Ukraine during the war, *Foreign Ukraine*, (In Ukrainian.) https://foreignukraines.com/2023/07/19/foreign-scientists-advised-how-to-support-ukrainian-science-during-the-war/

52 ISC and ALLEA, 2023, op. cit., p. 33

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trend, with a partial return of scientific researchers and the renewal or intensification of scientific activity.[53]

It should be noted that, when compared to those who remained in Ukraine without relocating or who moved abroad, researchers who were internally displaced also faced difficulties in continuing their research. For instance, internally displaced researchers, especially those in the conflict zone, expressed a particular need for uninterrupted internet access, whereas those abroad needed financial aid, social support and places to live.

The Council of Young Scientists at the MESU identified the needs of 618 Ukrainian scientists who left Ukraine because of the war. Almost 42% claimed that they would return when the war would be over, 30% did not know and 28% said that they were not planning to return.[54]

Later research conducted in mid-2023 by the UAScience.Reload initiative[55] showed that 90% of the respondents[56] were in Ukraine, and the remaining 10% were abroad.

53 V.Y. Gryga and Y.O. Ryzhkova, 2022, Research and innovation in Ukraine: approaches to policy making in times of war, *Ekonomika i prognozuvannia,* Vol. 4, pp. 88–108. (In Ukrainian.) https://doi.org/10.15407/eip2022.04.088

54 Y. Polishchuk, I. Lyman and S. Chugaievska, 2023, The "Ukrainian Science Diaspora" initiative in the wartime, *Problems and Perspectives in Management,* Vol. 21, Spec. Iss. 2, pp. 153-161. https://doi.org/10.21511/ppm.21(2-si).2023.18

55 More information can be found here: https://www.uascience-reload.org/.

56 In this research, there were approximately 2,000 respondents that were surveyed.

51.8% of those abroad said they intended to return to Ukraine after the war, emphasising potential repatriation and the importance of creating conditions for their return. The research also shows that 10.5% of researchers plan to return before the war's end, while 11.4% do not plan to return even in the long run. Therefore, it is estimated that over 85% of scientists want to return in the short or long term. 'Fellowships and large research grants to do science in Ukraine could be effective tools to encourage such return migration.'[57] However, it is worth noting that the survey was conducted shortly after the beginning of the full-scale invasion, and according to the available evidence, the length of the war may conceivably impact the desire to return.

The financial status of scientists

The negative economic impact of the war is evident on a personal level. Thus, according to the research conducted in the UAScience.Reload initiative (2023), 83.8% of respondents claimed that their financial situation worsened.[58] A large proportion of the researchers (39.7%) said they had funds for food only, while 27.7% could afford food and clothes but faced difficulties buying long-term-use goods, such as gadgets. Despite the difficulties, 81.1% of researchers continued to be paid wages, and only 2.3% said their wages were cut.

> *It is estimated that over 85% of scientists want to return in the short or long term.*

However, 72.9% of the respondents expressed inability to do research as fully as in the period before 24 February 2022. They mentioned feelings of endangerment, the inability to be present at the workplace, technical problems and apathy or a general absence of interest as complicating factors.

Additionally, the results of the survey underscore gender and family differences. Women with children often expressed a stronger need for support, especially in terms of finding employment abroad. At the same time, men (including those with children) tend to be limited to looking for research-related jobs inside Ukraine. This is caused by the current restrictions imposed by the martial law concerning the international travel of Ukrainian men and certain groups of women of conscription age.

A further, third, round of UAScience.Reload research conducted in mid-2023[59] showed that 88% of researchers continued to receive wages, but many of them said there were challenges like increased workload, delays in wage payments and cuts in paid working hours.

Also worthy of note is that only a relatively narrow circle of Ukrainian researchers participates in international and national grant programs – only 24.9% of the respondents of the UAScience. Reload initiative said they participated in projects funded by the EU or international donors. However, the related challenges, such as putting projects on hold because of the war, underlined the need for research structures adapted to wartime conditions.

Professional problems

The war continues to substantially and negatively impact the professional lives of researchers. 29.4% of all research institutions in Ukraine have undergone some physical damage caused by the war.[60,61] This significantly complicates work processes for Ukrainian researchers.

Overall, between 2014 and 2022, 31 higher and post-graduate educational institutions and 10 scientific research institutions have been relocated to safer cities and regions of Ukraine. Although some of these relocations took place in 2014, there were many more in 2022. After 24 February 2022, ten universities from Donetsk and Luhansk regions went through the relocation process for the second time,[62] losing all material assets generated after the first relocation. This state of affairs poses enormous challenges for the entire higher education system in Ukraine and negatively impacts the status of researchers.[63] Another challenge in wartime is preserving museum, archival, library and

57 I. Ganguli and F. Waldinger, 2023, War and Science in Ukraine, *NBER Working Paper* 31449, https://doi.org/10.3386/w31449

58 This is also highlighted in a recent article by Yuri Khalavka, available at: https://zn.ua/ukr/science/choho-potrebujut-ukrajinski-naukovtsi-v-chasi-vijni-ta-shcho-voni-mozhut-dati-krajini.html.

59 More information can be found here: https://www.uascience-reload.org/

60 *Education under Threat*, n.d., (In Ukrainian.) https://saveschools.in.ua/

61 O. Verba, O. Herasymchuk and P. Bohutskyi, 2023, Hero City: Crippled by Russian Attacks, Ukraine's Science Hotbed Refuses to Give Up, Science, Vol. 382, NO. 6398, pp.1142-1144. https://www.science.org/content/article/hero-city-crippled-russian-attacks-ukraine-s-science-hotbed-refuses-give

62 Additional information can be found here: https://unesdoc.unesco.org/ark:/48223/pf0000384454

63 The proposed amendment to Article 8(2)(b)(iv) of the Rome Statute would define Ecocide as the 'unlawful or wanton acts committed with knowledge that there is a substantial likelihood of severe and either widespread or long-term damage to the environment being caused by those acts.' See https://www.stopecocide.earth/legal-definition). More generally, see https://europeanlawinstitute.eu/projects-publications/publications/eli-report-on-ecocide/

scientific collections, and cultural and natural heritage objects,[64] which are frequently subject to attack.

Research processes have been significantly impacted due to enforced shifts in research topic areas. For example, the occupation and deployment of mines in the Azov Sea has led to a complete loss of access to those territories, as well as the destruction of the dam of the Kakhovka Reservoir and, consequently, of the local ecosystem. Ukrainian researchers have characterised this as 'ecocide' and such acts may come within the existing definition of ecocide in international law and very probably within the recently proposed new definition.[65]

The challenges involved in obtaining permits for academic mobility abroad under martial law present significant difficulties for male scientists engaged in research.[66] This may go some way to explaining why, according to the Unified State Electronic Database on Education of Ukraine (USEDE), men predominate in Doctor of Philosophy (Ph.D.) programs in the 2023 admission cycle, with the number of male applicants being several times higher than that of women.

The age distribution of new Ph.D. admissions shows a rapid increase in the number of men over the age of 30 in 2023 compared to the 2021 admission process. This may be explained by, among other factors, the possibility of obtaining a deferment from military mobilisation for those pursuing a Ph.D.[67] Conversely, the notable reduction in the number of female admissions to doctoral programmes may be attributed to their capacity to pursue opportunities abroad and employment in foreign research institutions. If maintained, this trend may result in a decline in the number of female scientists in Ukraine in the future.

Safety considerations

Limitations caused by safety and technical considerations are impeding the efficiency of Ukrainian scientists in conducting their work during the war. A significant proportion of scientists (54.3%) reported that they were unable to conduct research at the same level as before the war. This can be attributed to a number of factors, including not only the heightened sense of endangerment, but also certain technical challenges faced by the scientific community. These include power and water outages, which may potentially disrupt research activities in laboratories, as well as the deployment of landmines,[68] which can limit the suitability of those areas for research and cultivation.

Data from *Web of Science* shows that, since February 2022, the publishing activity of Ukrainian researchers decreased by approximately 10%.[69] In 2022, the number of publications by Ukrainian researchers co-authored with Russians decreased by over 40%, and those co-authored with Belarusians by 30%, compared to 2021.[70]

It is also noteworthy that Science at Risk! project[71] (2023) revealed a societal and governmental tendency to prioritise investment in primary survival needs over science. To address this issue, effective scientific advocacy is essential to engage with government, businesses, civil society, international governmental and non-governmental organisations, and funders.

64 Y. Nikolaiev, G. Riyand I. Shemelynets, 2023, War in Ukraine: Reshaping the Higher Education Sector, Analytical Report. Kyiv: Borys Grinchenko Kyiv University, p. 51. https://osvitanalityka.kubg.edu.ua/wp-content/uploads/2023/04/HigherEd-in-Times-of-War-EN.pdf

65 The data were obtained within a study of the "Science at Risk!" project (2023)

66 I. Kuchyn, K. Bielka L. Lymarand L. Puljak, 2024, Academic performance, perceptions, and motivations of medical PhD students in Ukraine during wartime: a mixed methods study, *BMC Med Educ*. Vol. 24, No. 1, p. 1421, 1421. doi: 10.1186/s12909-024-06400-3

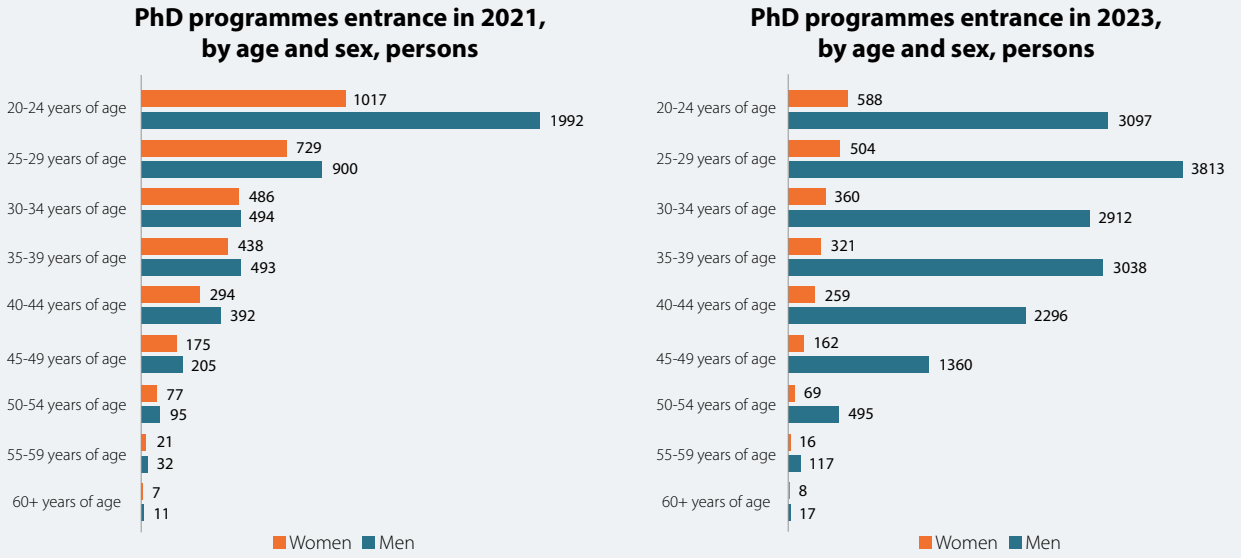
67 See for example the following news media reports: https://newsukraine.rbc.ua/news/new-draft-law-on-mobilization-who-qualifies-1703542375.html and https://itc.ua/en/news/in-reserve-online-deferment-from-mobilization-has-been-launched-who-can-use-it-and-how-to-apply/; The relevant laws can be found here: 1) https://ips.ligazakon.net/document/view/kp220194?an=1; 2) https://zakon.rada.gov.ua/laws/show/76-2023-%D0%BF#Text ; 3) https://vspu.edu.ua/content/vs/doc/d2.pdf; and for ongoing Ph.D. work in the medical sciences, see I. Kuchyn et al., op. cit.

68 R. Stone, 2023, Out of the ashes: Near Chornobyl, a war-scarred town plans a nuclear research revival, Science, Vol. 382, No,6398, pp. 1136-1138. https://www.science.org/content/article/out-ashes-near-chornobyl-war-scarred-town-plans-nuclear-research-revival

69 I. Ganguli and F. Waldinger,2023, op. cit.

70 Ibid.

71 More about the project can be found here: https://scienceatrisk.org/



**Source: the Unified State Electronic Database on Education of Ukraine.*[72]

In addition to the challenges posed by the ongoing war, the freedom and safety of scientists and researchers should not be viewed in isolation from the implementation of recommendations made by human rights bodies, in particular during the Universal Periodic Review (UPR) process in respect of human rights in Ukraine.[73] Given the government's acceptance of UPR recommendations that highlight the need to strengthen legal frameworks to protect human rights, such as labour rights and freedom of expression, and mechanisms already ongoing to do so,[74] these measures should also integrate analogous protections for scientists and scientific researchers.

Ph.D. program demographics

Most striking, however, are the numbers entering or already part of Ph.D. programmes. According to the USEDE, the number of women who enrolled in Ph.D. programmes in Ukraine decreased from 3,067 in 2020 to 2,287 in 2023. By contrast, the number of men rose dramatically from 4,190 in 2020 to 17,144 in 2023. This sharp increase may have been influenced by the fact that men enrolled in full-time Ph.D. programmes may defer being conscripted to serve in the Army of Ukraine. Research careers in Ukraine do not appear to be particularly attractive to young specialists: in 2022, only 15.6% of researchers were younger than 35, while 22% of the working scientists were older than 65.[75] One reason for this may be the introduction of a rule in 2022 that requires a Ph.D. to be completed within four years,[76]

72 *The Unified State Electronic Database on Education of Ukraine,* https://info.edbo.gov.ua/ [accessed 1 June 2024]

73 See for example UN General Assembly Report of the Working Group on the Universal Periodic Review (3 January 2018) UN Doc A/HRC/37/16 and related Matrix of Recommendations, as well as Ukraine's Views on Conclusions and/or Recommendations, Voluntary Commitments and Replies (23 February 2018) UN Doc A/HRC/37/16/Add.1.

74 See for example *Interim Report on Implementation of the Recommendations Received by Ukraine Within the Third Cycle of the Universal Periodic Review* (2020).

75 T.V. Pysarenko, T.K. Kuranda et al., (2023). op. cit. Figure 2.5. To compare, the share of researchers aged 34 years and less in several EU countries for which the data are available, is 15 to 30%, while in no country does the share of researchers aged 65 and older exceed 10%. Please see: Researchers by sector of performance, age class and sex. https://ec.europa.eu/eurostat/databrowser/bookmark/26e530c5-2079-454a-9c7b-2b659c29d142?lang=en

76 Resolution of the Cabinet of Ministers of Ukraine "On the approval of the Procedure for awarding the degree of Doctor of Philosophy…" No. 44, 2022, (In Ukrainian.) https://zakon.rada.gov.ua/laws/show/44-2022-%D0%BF#Text

or it must be restarted.[77] In addition to the much lower wages for early career researchers mentioned above, the Ukrainian scientific system prioritises support for experienced researchers (more advantages during competitions for vacancies, accessing grant funding for research, etc.) over their early-career junior colleagues.

> *Research careers in Ukraine do not appear to be particularly attractive to young specialists: in 2022, only 15.6% of researchers were younger than 35, while 22% of the working scientists were older than [65].*

Universities struggle to attract scientists too. The culture of research in Ukraine is such that research activities are primarily associated with the research institutes of the NAS of Ukraine, while in the universities, research is mainly conducted as an addition to teaching activities.[78] Despite the expectations being as high as for personnel employed in research institutes, basic research is mainly conducted in the NAS of Ukraine. As of the beginning of the 2022-2023 academic year, there were only 572 'pure' research positions across all Ukrainian universities.[79] Most university research is done by faculty during time away from working with students and funding for research is limited. An additional challenge facing universities is that only 10% of the total State research funding goes to university researchers, the balance being allocated to scientific institutions rather than universities.[80] Despite the limited funding, university faculty members are under considerable pressure to publish their research findings in journals that are indexed in the *Scopus* or *Web of Science* databases. In several sub-fields of the social sciences and humanities, problems such as limited time and fewer resources to do research, insufficient levels of English and other unfavourable conditions such as chronic underinvestment and lack of access to the knowledge frontier, are exacerbated by a 'publish or perish' culture. This has resulted in the proliferation of paper mill produced, low-quality publications in predatory journals.

77 International experience shows that completion of doctorate research requires more time. For instance, it takes the US postgraduate students 7.3 years on average to prepare their Ph.D. theses. (https://www.statista.com/statistics/240170/years-needed-to-complete-a-doctorate-in-the-us). As of 2020, in Finland this time period was between 4.8 and 6.8 years, depending upon the research speciality (M. Ijäs-Idrobo, 2021, Doctoral researchers and doctoral training in Finland in the 2020s, *Eurodoc conference*, Prague, July 14, http://eurodoc.net/sites/default/files/attachments/2021/404/presentationofmiiaijas-idrobo.pdf).

78 Available at: https://www.nature.com/articles/s41599-023-02346-x

79 State Statistics Service of Ukraine, 2023, *Higher and professional pre-higher education in Ukraine in 2022*, Table 2.17.

80 T.V. Pysarenko, T.K. Kvasha et al., 2023, op. cit., p. 17.

3 Actions implemented to improve the status and well-being of scientists in Ukraine

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Ukrainian scientific researchers continue their work despite the challenges posed by the damage to Ukraine's infrastructure, particularly the destruction of its educational and scientific infrastructure, forced internal displacement, circumstances that impel relocation abroad, adverse psychological impacts and inadequate material and financial provision. The Ukrainian government and foreign donors are working to swiftly rebuild scientific infrastructure to minimise interruptions in the work of scientific researchers and research.

The following is an overview of the measures introduced to support and improve the well-being of Ukrainian scientists within the framework of adopted normative legal acts in Ukraine and financial support from Ukrainian and international stakeholders.

Before 24 February 2022

The main principles of the State's policy on the status and well-being of scientists in Ukraine are defined by separate articles of the Ukrainian Laws "On Scientific and Scientific-Technical Activities"[81], "On Higher Education"[82] and "On Education".[83] These laws were adopted before February 2022 and remain in force. The legislation is intended exclusively for scientist-educators who also engage in teaching activities at universities. Article 57 of the Ukrainian Law "On Education" stipulates that the State must provide educators and scientist-educators with appropriate work conditions and healthcare, payments for advanced training courses, legal, social and professional protection, differentiation of salaries according to their position, and other social guarantees.

81 The Ukrainian Law "On Scientific and Scientific-Technical Activities" No. 848-VIII (2015). https://zakon.rada.gov.ua/laws/show/en/848-19#Text

82 The Ukrainian Law "On Higher Education" No. 1556-VII (2014). https://zakon.rada.gov.ua/laws/show/en/1556-18#Text

83 The Ukrainian Law "On Education" No. 2145-VIII (2017). URL: https://zakon.rada.gov.ua/laws/show/en/2145-19#Text

Also, while a mobilised researcher or lecturer would be 'dismissed in connection with military service', which effectively terminates the employment relationship, the researcher's institutional position would still be retained. The researcher's institutional salary would be replaced by an army salary. Since the institutional position is retained, however, after demobilisation, the researcher or educator could return to work and receive a salary from their institution. Article 59 of the same legislation guarantees appropriate working conditions, advanced training and additional payments for scientific degrees and academic statuses for scientists-educators, scientists, educators and other employees of universities.[84] Even broader State guarantees for Ukrainian scientists (including the social and legal status of researchers and science officers) are defined in Chapter III of the Ukrainian Law "On Scientific and Scientific-Technical Activities".

Even before 2022, the State could not always provide these guarantees. According to an analysis published by the Organisation for Economic Co-operation and Development (OECD), science and research in Ukraine were in a transitional period – the number of scientists in the country was decreasing, and research expenditure relative to GDP shortened by nearly one-third in the period from 2013 to 2018.[85]

After 24 February 2022

The full-scale invasion aggravated pre-existing problems of science funding in Ukraine, and negatively impacted provisions for scientists and their research. In 2022, nominal funding for the NAS of Ukraine was 17% lower than the amount approved in the budget for that year and 2.6% lower than in 2021.[86] The significant devaluation of the Ukrainian hryvnia against the United States dollar[87] and the high rates of inflation[88] in 2022 mean that the real decrease in science funding and Ukrainian researchers' income is much larger. The National Research Foundation of Ukraine (NRFU) put its grant assistance on hold[89] following the Resolution of the Cabinet of Ministers of Ukraine of March 10, 2022, No. 245, "On the Reallocation of Funds to the Reserve Fund of the State Budget".[90] Through this resolution, the government also decreased funding for education expenditures in 2022.

> *In 2022, nominal funding for the National academy of sciences of Ukraine was 17% lower than the amount approved in the budget for that year and 2.6% lower than in 2021.*

After 24 February 2022, a number of new pieces of legislation as well as amendments to existing legislation were approved to secure the status and welfare of Ukrainian scientists under martial law. On 15 March 2022, the *Verkhovna Rada* (the Parliament of Ukraine) approved amendments to the Law "On Education", adding a separate article 57-1. This provides State guarantees for students and employees of research institutes and HEIs in respect of organising remote education, maintaining job positions for faculty and researchers, average wages, providing payments guaranteed by the law and providing (if required) a place to live and food to eat during conditions of martial law, emergency or a declared state of emergency.[91] In November 2023, the *Verkhovna Rada* voted in favour of a bill amending several laws and repealing this provision.[92]

84 Part 2 of Article 59 states: 'Scientific-pedagogical, scientific and pedagogical staff at the institutions of higher education shall receive additional payments for doctor of philosophy and doctor of science degrees in the amount of 15% and 25% of the salary respectively, as well as for academic titles of associate professor and senior researcher – 25% of the salary, and professor – 33% of the salary. The institution of higher education may set a larger amount of additional payments from its own revenues'.

85 OECD, 2022, The future of science in Ukraine: Actions now will affect post-war recovery, *OECD Policy Responses on the Impacts of the War in Ukraine*, OECD Publishing, https://doi.org/10.1787/afbd05df-en

86 National Academy of Sciences of Ukraine, 2023, *The National Academy of Sciences of Ukraine Annual Report 2022*,p. 502. (In Ukrainian.). https://files.nas.gov.ua/PublicMessages/Documents/0/2023/05/230509205447582-3171.pdf

87 As of December 30, 2021, the official exchange rate of the National Bank of Ukraine was 27.2077 UAH for 1 USD, while one year later, on December 30, 2022, the rate was 36.5686 UAH/USD. Therefore during 2022, the Ukrainian hryvnia devalued to the US dollar by 25.6%.

88 The consumer price index in 2022 in Ukraine was 126.6. See https://index.minfin.com.ua/ua/economy/index/inflation/.

89 National Research Foundation of Ukraine,2022, *National Research Foundation of Ukraine Annual Report 2022*,p. 9. (In Ukrainian.) https://nrfu.org.ua/wp-content/uploads/2023/04/zvit-2022-finalnyj_merged-2.pdf

90 Resolution of the Cabinet of Ministers of Ukraine "On the Reallocation of Funds to the Reserve fFnd of the State Budget" No. 245 (2022). (In Ukrainian.) https://zakon.rada.gov.ua/laws/show/245-2022-%D0%BF#Text

91 The Ukrainian Law "On Amendments to Certain Laws of Ukraine Regarding State Guarantees under Martial Law, Emergency or State of Emergency" No. 2126-IX (2022). (In Ukrainian.) https://zakon.rada.gov.ua/laws/show/2126-20#n2

92 The Ukrainian Law "On Amendments to Certain Legislative Acts of Ukraine Concerning the Regulation of the Granting and Use of Leave, as well as Other Issues" No. 3494-IX (2023). https://zakon.rada.gov.ua/laws/show/3494-20?lang=en#Text

In the 2022-2023 period, amendments were made to the Ukrainian Law "About Scientific and Scientific-Technical Activities" and to several government resolutions[93] concerning the NRFU.[94] These changes, among other things, allowed the Foundation to attract international donor funds with greater scope.[95] Given the already limited State funding, this was imperative, not just for an institution's continued functioning[96] but also for supporting Ukrainian scientists through additional grant opportunities.

The State supports Ukrainian scientists by conferring salary bonuses, scholarships and awards, but the extent of this support and the number of its recipients are meagre. In September 2023, governmental scholarships for 120 scientists-educators of universities were approved,[97] and funds in the budget programs were redistributed to pay premiums, scholarships and grants.[98] In November 2023, the MESU also approved 25 annual scholarships dedicated to the Day of Dignity and Liberty to the most promising young scholars, amounting to around $140 monthly.[99] The procedure for granting the National Academy of Sciences of Ukraine Award "For Science Popularization"[100] was also approved.

During the period of martial law, a number of issues have either been placed on hold or deemed irrelevant. These include the augmentation of salary rates for researchers, the ratification of the State Program for the Development of Research Infrastructure for 2021-2026 and the abolition of taxes on foreign research and development grants.[101]

> *The Fund of the President of Ukraine for the Support of Education, Science, and Sports helps Ukrainian universities find partners, organize academic exchanges and create double degree programs.*

International support

The gravity of the 'brain drain' and its potential impact on post-war recovery has been recognised by the MESU, and by several international institutions, which have therefore supported the "Ukrainian Scientific Diaspora" initiative.[102] This is directed at uniting the efforts of Ukrainian scientists from different migration waves for the recovery and development of Ukraine, and the more efficient integration of Ukrainian scientists into the world scientific community. In turn, the Fund of the President of Ukraine for the Support of Education, Science, and Sports helps organize Ukrainian universities find partners in Great Britain, organize academic exchanges and create double degree programs.[103]

93 Resolution of the Cabinet of Ministers of Ukraine "On Amendments to Certain Resolutions of the Cabinet of Ministers of Ukraine Regarding the National Research Foundation of Ukraine" No. 742 (2023). (In Ukrainian.) https://zakon.rada.gov.ua/laws/show/742-2023-%D0%BF; and Resolution of the Cabinet of Ministers of Ukraine " Certain issues of the National Research Foundation" No. 808 (2023). (In Ukrainian.) https://zakon.rada.gov.ua/laws/show/808-2023-%D0%BF

94 The Ukrainian Law "On Amendments to the Law of Ukraine "On Scientific and Scientific-Technical Activities" in Relation to the National Research Foundation of Ukraine" No. 2842-IX (2022). (In Ukrainian.) https://zakon.rada.gov.ua/laws/show/2842-20

95 National Research Foundation of Ukraine, 2022, op. cit., p. 35.

96 National Research Foundation of Ukraine, 2022, op. cit., pp. 5–6.

97 Order of the Cabinet of Ministers of Ukraine "On awarding the Cabinet of Ministers scholarships for outstanding achievement in higher education" No. 858-p (2023). (In Ukrainian.) https://www.kmu.gov.ua/npas/pro-pryznachennia-stypendii-kabinetu-ministriv-ukrainy-za-vydatni-zasluhy-u-sferi-vyshchoi-osvity-858r-290923

98 Order of the Cabinet of Ministers of Ukraine "On the reallocation of certain state budget expenditures provided for the Ministry of Science and Education in 2023" No. 964-p (2023). (In Ukrainian.) https://www.kmu.gov.ua/npas/pro-pererozpodil-deiakykh-vydatkiv-derzhavnoho-biudzhetu-peredbachenykh-ministerstvu-osvity-i-nauky-na-2023-rik-i201023-964

99 Ministry of Science and Education of Ukraine, 2023a, *On awarding scholarships to the best young scientists on the occasion of the Day of Dignity and Freedom*, (In Ukrainian.) https://mon.gov.ua/ua/news/pro-priznachennya-stipendij-najkrashim-molodim-vchenim-do-dnya-gidnosti-i-svobodi

100 National Academy of Sciences of Ukraine, 2022, *The procedure for nominating the candidates and documents processing for the participation in the competition for the NAS of Ukraine award "For Popularizing the Science"*, (In Ukrainian.) https://files.nas.gov.ua/PublicMessages/Documents/0/2022/06/220608143810735-7894.pdf

101 Ministry of Science and Education of Ukraine, 2023b, 2022 *MoES Operative Plan Implementation Report*, p. 66-75. (In Ukrainian.) https://mon.gov.ua/storage/app/media/rizne/Plany.roboty/2023/31.01.2023/Zvit.pro.vykon.operatyvn.planu.MON-2022-30.01.2023.pdf

102 Y. Polishchuk,I. Lyman and S. Chugaievska, 2023, op. cit.

103 *The Fund of the President of Ukraine for the support of Education, Science, and Sports*, n.d., https://presidentfund.gov.ua/?lang=en

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These initiatives have become even more important because there have been reports of faculty members' contracts being terminated due to their inability to conduct classes offline,[104] delays in the payment of salaries[105] and the forcing of scientists and educators to go on unpaid leave.[106] At the Taras Shevchenko National University of Kyiv, the second-largest university in Ukraine in terms of student numbers, over 50 faculty members resigned in protest at the university's inability to facilitate online teaching.[107]

Yet, Ukrainian scientists abroad also face difficulties in finding jobs in universities or research institutes, because they typically require a Ukrainian affiliation to obtain such positions. This means that Ukrainian scientists whose contracts have been terminated since February 2022 tend to automatically lose the possibility of quickly finding a job in the academic sphere abroad.[108]

A number of other international opportunities for Ukrainian researchers have emerged, however. On 30 March 2022, Ukraine became the thirty-ninth full member of the European Cooperation in Science and Technology (COST).[109] At the beginning of May 2022, the *Verkhovna Rada* of Ukraine ratified the Treaty with the EU on the participation in the Horizon Europe Research and Innovation Framework Program and the European Atomic Energy Community Program for Research and Education

104 L. Danylenko, 2023, Масові звільнення в українських університетах: «закордон» заважає? (Mass dismissals in Ukrainian universities: "abroad" interferes?), *lb.ua.* https://lb.ua/society/2023/10/09/578436_masovi_zvilnennya_ukrainskih.html

105 Educational Ombudsman of Ukraine, n.d. Освітній омбудсмен звертається до органів влади усіх рівнів – усунути порушення прав щодо виплати заробітної плати працівникам закладів освіти (The Educational Ombudsman appeals to the authorities of all levels – to eliminate violations of rights to pay wages to employees of educational institutions), https://eo.gov.ua/osvitniy-ombudsmen-zvertaietsia-do-orhaniv-vlady-usikh-rivniv-usunuty-porushennia-prav-shchodo-vyplaty-zarobitnoi-platy-pratsivnykam-zakladiv-osvity/2022/06/20/

106 E. Barsuov, 2022, забороняють примусово відправляти педагогів у відпустку без зарплати (The Ministry of Education and Science prohibits forcibly sending teachers on leave without a salary), *Ukrainian Pravda,* https://life.pravda.com.ua/society/2022/02/28/247597/

107 Ректор КНУ Шевченка розповів про проблему з викладачками і викладачами (Rector of KNU Shevchenko told about the problem with teachers and teachers), Ukrinform. https://www.ukrinform.ua/rubric-society/3755582-rektor-knu-sevcenka-rozpoviv-pro-problemu-z-vikladackami-i-vikladacami.html

108 Order of the Cabinet of Ministers of Ukraine "Some issues of organising the work of civil servants and employees of state bodies during martial law". N 440 (2022). (In Ukrainian.) https://ips.ligazakon.net/document/view/KP220440?an=1

109 Ministry of Science and Education of Ukraine,2022, *Ukraine has become a full member of the COST association*, (In Ukrainian.) https://mon.gov.ua/ua/news/ukrayina-stala-povnopravnim-chlenom-asociaciyi-cost

(2021-2025).[110] This enables enhanced and expedited access for Ukrainian researchers to EU funding programs, research facilities and other resources, thereby fostering more robust research collaborations. Resolution of the Cabinet of Ministers of Ukraine No. 599 from May 13, 2022, outlined the details of the procedure for Ukrainian participation in the programs of international mobility and education abroad.[111] Collaboration prospects with foreign partners broadened through calls for proposals for two-sided research projects.[112]

> *Ukrainian scientists abroad face difficulties in finding jobs in universities or research institutes, because they typically require a Ukrainian affiliation to obtain such positions.*

There are at least two levels of international aid to Ukrainian researchers and scientists-educators – pan-European and national.[113] On 24 February 2022, the government bodies of the EU decided to prolong collaboration with Ukrainian researchers engaged in joint and academic mobility projects. Furthermore, the redistribution of costs previously allocated to Russian and Belarusian projects has led to an augmentation of funding for Ukrainian researchers, including for the establishment of special programmes such as ERA4Ukraine, Horizon4Ukraine and Marie Skłodowska-Curie Actions for Ukraine, with a total budget of approximately 70 million Euros.[114]

At the national level, Poland, Germany, France, Spain, Italy and other countries provided substantial aid and support to Ukrainian researchers,[115] including the allocation of academic scholarships, facilitation of participation in research programs and the introduction of national programs designed to support Ukrainian researchers.[116] Universities and research institutes were the main beneficiaries of this support, as they established new employment opportunities and maintained existing positions, while also forging partnerships that benefited Ukrainian researchers.[117]

International structures such as the National Academy of Sciences of the United States, the International Science Council, the InterAcademy Partnership, Max Planck Society,[118] the European Federation of Academies of Sciences and Humanities (ALLEA), the International Science Council's Committee for Freedom and Responsibility in Science, the European University Association,[119] the European Research Council[120] and others[121] expressed their solidarity and support. Several also focused on providing financial support to Ukrainian scientists through grants for research and continuing existing employment contracts or creating new opportunities in European institutions.

To facilitate the search for initiatives supporting Ukrainian scientists, at the beginning of the invasion, researchers and students from academic institutions in Europe and around the world launched the volunteer-

110 Cabinet of Ministers of Ukraine, 2022 *The Verkhovna Rada of Ukraine has ratified the Agreement between Ukraine and the European Union and European Atomic Energy Community*, (In Ukrainian.) https://www.kmu.gov.ua/news/verhovna-rada-ukrayini-ratifikuvala-ugodu-mizh-ukrayinoyu-yevropejskim-soyuzom-ta-yevropejskim-spivtovaristvom-z-atomnoyi-energiyi

111 Resolution of the Cabinet of Ministers of Ukraine "On amending several resolutions of the Cabinet of Ministers of Ukraine regarding academic mobility issues" No. 599 (2022). (In Ukrainian.) https://zakon.rada.gov.ua/laws/show/599-2022-%D0%BF#Text

112 Ministry of Science and Education of Ukraine, 2023b, op. cit., p. 62–63.

113 Y. Nikolaiev et al., 2023, op. cit., p. 37.

114 *Ministry of Science and Education of Ukraine*, 2023b, op. cit., p. 60.

115 A. Smahina, 2023, The future of Ukrainian science: how is it supported during the war?, *Rubryka*, https://rubryka.com/en/article/science-support-in-ukraine/

116 T. Kaluzhna, 2022, International support for Ukrainian scientists in the conditions of war, *Adult Education: Theory, Experience, Prospects*, Vol. 22, No.2, pp. 84-96. (In Ukrainian.) https://doi.org/10.35387/od.2(22).2022.84-96

117 EUA, 2022, *Support to Ukrainian higher education*, https://www.eua.eu/downloads/publications/presentation_support%20to%20ukrainian%20he_vers20-09-2022.pdf.

118 The Statement by the President of the Max Planck Society can be found here: https://www.mpg.de/18354975/statement-mpg-president-stratmann-war-ukraine

119 ISC and ALLEA, 2023, op. cit., p. 30-37.

120 European Research Council, n.d., *ERC for Ukraine*, https://erc.europa.eu/apply-grant/erc-ukraine.

121 A list of the available resources for Ukrainian researchers is presented in the paper: W. Wolfsberger, K. Chhugani, K. Shchubelka, A. Frolova, Y. Salyha, O. Zlenko, M. Arych D. Dziuba, A. Parkhomenko, V. Smolanka, Z.H. Gümüş, E. Sezgin, A. Diaz-Lameiro, V.R. Toth, M. Maci, E, Bortz, F. Kondrashov, P.M. Morton, P.P. Łabaj , and T.K. Oleksyk, 2022, Scientists without borders: Lessons from Ukraine, *GigaScience*, Vol. 12, giad045, https://doi.org/10.1093/gigascience/giad045

led NGO, #ScienceForUkraine.[122] As of May 2022, the database of projects created under the initiative included over 2,000 opportunities for Ukrainian students and researchers, usually short-term residencies lasting from a couple of weeks to 2 to 3 months. There are also longer-term options, usually for up to two-three years.[123] Geographically, the opportunities for researchers are primarily located in Europe (mostly in Germany, France and Poland), with a smaller number in the USA and Canada.[124] The overwhelming majority of the opportunities required the relocation of scientists to institutions abroad or were intended to support those already outside of Ukraine.[125] However, most Ukrainian scientists have remained in Ukraine.[126]

International support for Ukrainian researchers remains substantial. Assisting Ukrainian scientists creates a win-win situation for all stakeholders, as researchers continue to conduct research, produce new knowledge and bolster the authority of both those who fund research and Ukrainian research institutes and HEIs. The international community benefits from new knowledge and research, scientists retain the ability to make a living and conduct their research, and Ukraine benefits through an increasingly influential and powerful scientific community with international experience to aid in its post-war recovery. While at the host institution, scientists often combine their research activities with the provision of online lectures for Ukrainian audiences.

122 *Science for Ukraine,* n.d., https://scienceforukraine.eu/

123 M. Maryl, O.V. Ivashchenko, M. Reinfelds, S. Reinsone and M.E. Rose, 2022, Addressing the needs of Ukrainian scholars at risk, *Nature Human Behaviour*, Vol. 6, No.6, pp. 746–747. https://doi.org/10.1038/s41562-022-01387-7

124 W. Wolfsberger et al.,2022, op. cit.

125 Ibid.

126 ISC and ALLEA, 2023, op. cit., p. 15.

4 Gaps in existing research on the impact of the war on the Ukrainian science ecosystem

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The dramatic increase in global interest in Ukraine following the invasion in 2022 is reflected in the substantial growth of research papers dedicated to various aspects of the conflict. In the science database *Scopus* alone, a "War in Ukraine" request returns 1,451 documents from 2022-2023. The number of publications dedicated to war or armed conflict in Ukraine increased by 579.6% in 2022 compared to 2021.[127] 52% of these publications analyse the conflict as a full-scale war and highlight its consequences for global energy, food and other types of safety and security.[128] It is noteworthy that only 60% of those that do so are by authors with Ukrainian affiliation. However, the current state of research on the Ukrainian scientific ecosystem during the war cannot be considered sufficient or systematic.

Some reasons for this include:

- Conducting research on all critical aspects of the Ukrainian scientific ecosystem during the war necessitates the collaboration of highly qualified researchers who are motivated, able to cope with the psychological impacts of the war, and secure enough financially to dedicate sufficient time to the research without being distracted by the need to seek other sources of income. This is particularly challenging for Ukrainian scientists and their families since 24 February 2022 because income levels influence basic survival concerns.
- The dynamic nature of changes caused by the war, which quickly renders data obsolete or outdated.
- There is a lack of the high-quality data sets necessary for a thorough analysis of the scientific system in Ukraine. Additionally, data collection practices in Ukraine do not meet EU criteria – despite recent successful synchronisation in terminology, there is still a substantial lack of access to the data and the lack of synchronisation across the institutions, such

127 Derived from a search of the Scopus database conducted in November 2023: https://www.scopus.com

128 L. Ostapenko, A. Vorontsova, I. Voronenko, I. Makarenko and S. Kozmenko, 2023, Coverage of the Russian armed aggression against Ukraine in scientific works: Bibliometric analysis, *Journal of International Studies*, Vol. 16, No. 3, pp. 9-33.

as ministries and academies of sciences, as well as the level of granularity of the data. This hinders Ukrainian integration into the EU, undermines evidence-based policymaking and significantly complicates reliable evaluation of research effectiveness and efficiency.

Among the critical gaps in the currently available research on Ukraine's wartime scientific ecosystem are the following:

- Multifaceted comparative research of the challenges and needs of Ukrainian scientists who are: (a) abroad; (b) under occupation; (c) in their existing places of residence in territories under Ukrainian control but close to the frontline; (d) in their existing places of residence in territories under the Ukrainian control but away from the frontline; (e) in Ukrainian territory, but with the status of IDPs; (f) residing with relatives in Ukrainian territory far from the frontline, and without the status of IDPs;
- Assessment of whether the support instruments for young researchers correspond to their needs;
- The status of personnel within the network of relocated universities in Ukraine. The paucity of research on this network is such that the number of relocated research institutions is a matter of varying declarations by government representatives and researchers;[129]
- The extent to which current research orientations and topics defined as a priority by the State aligns with the actual needs of the State and the future post-war recovery of Ukraine;
- The needs of the Ukrainian scientific diaspora in order to fully leverage their potential for the post-war recovery of Ukraine and facilitate their reintegration into the Ukrainian scientific community;
- Systematisation of the most effective Ukrainian and international practices for preserving and supporting human capital during the war and reintegrating researchers into the Ukrainian scientific community;
- The level of involvement of Ukrainian scientists in science diplomacy during the war;
- A critical examination of the requirements of Ukrainian researchers in relation to international opportunities that permit remote working (examples include the need for vacancies and grants that permit remote working, virtual mobility and outsourcing);
- Evaluation of the available tools to support Ukrainian researchers;
- Creation of a prosopographical portrait of Ukrainian scientists during the war;
- Shift in the research trajectory, characterised by the involvement of scientists who, prior to 2022, were members of international research teams under the auspices of, or with the active participation of, their Russian counterparts.

Addressing these gaps will facilitate greater attention to these issues, both within and outside Ukraine and allow for more effective solutions to the challenges identified. At the same time, the dynamic changes in the situation brought about by the war will require updates to the research, even in areas previously studied.

Center for Pediatric Cardiology and Cardiac Surgery, Kyiv
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Translation: Do not enter.

129 See: H. Lopatina, N. Tsybuliak,A. Popova, I. Bohdanov and Y. Suchikova, 2023, University without walls: Experience of Berdyansk state pedagogical university during the war, *Problems and Perspectives in Management*, Vol. 21 Spec. Iss. 2, pp. 4–14. https://doi.org/10.21511/ppm.21(2-si).2023.02; and O. Spivakovskiy, S. Omelchuk and O. Kazakova, 2023, *"Black swan" in the history of Kherson State University, or the chronicles of a relocated HEI*, (In Ukrainian.) http://dspace.ksu.ks.ua/handle/123456789/16757

5 Results of the focus groups

Scientific-Technological Complex "Institute of Single Crystals", Kharkiv
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This chapter reports on the outcomes of six focus-group discussions organised by the study. Participants identified the main problems faced by Ukrainian scientists, which are listed below. Issues for consideration when addressing these problems are presented in a separate section of this analytical report.

Focus group 'Relevance of support tools for young scientists to their needs'

A focus group meeting was conducted to determine the relevance of support tools for young scientists to their needs, which took place on 21 December 2023 and had a duration of 105 minutes. The group consisted of nine participants, five of whom were female and four were male, with an average age of 34. Among the participants, 3 were Doctors of Science,[130] 4 were Ph.D. holders, and 2 were Ph.D. students. They included residents of Kyiv, Vinnytsia, Lviv, Pavlograd, Kharkiv, Chernihiv and Boston.

According to those scientists, the most pressing problems for young scientists in Ukraine include:

- Lack of funding, with its many derivative problems, such as a negative view of future prospects, both in terms of salaries and careers. Further, there is an evident decline in the number of young scientists over the recent years.[131] The low wages experienced by scientists is a factor driving their decision to seek employment in other fields where higher salaries are typically offered: 'If I didn't have a financial safety net, I wouldn't have pursued a career in science after graduating school. Instead, I would have chosen a job with a stable income.'
- Unpredictable 'rules of the game' such as annual changes in legal requirements: 'How should scientists plan their work?'
- A sense of the devaluation of science and the low social status of scientists in Ukraine among others in view of the shrinking State funding and level of salaries.

130 The second-highest scientific honour is bestowed upon individuals who have made substantial contributions to advancing knowledge in their field, fostering new directions and visions in scientific research. This degree is only awarded to those already possessing Ph.D.s.

131 https://ihe.bc.edu/pub/i3oxjya7/release/2

- Deficit of authentic scientific expertise in Ukraine, which results in the misclassification of non-professionals as experts. It is troubling that there seems to be no correlation between expertise and remuneration, which is a significant source of discontent among early-career researchers.
- Bureaucratization and overregulation of research processes both at the State/MESU level and within research institutions: 'The procedure of applying for awards and scholarships in Ukraine seems to be designed in a way that favours not necessarily the best scientists, but those who know how to fill out the paperwork efficiently.'
- A significant proportion of junior scientists are engaged on a temporary or short-term basis, with contracts typically running from 1 September to 30 June. Indeed, after graduating, and having defended their theses, some young scientists report limited or only part-time employment opportunities. For example, some may be hired for only 25% of a full working day and for as long as six months. Instituting mechanisms that will support young scientists in their career development is one way to reduce the 'brain drain' that has been repeatedly identified as a significant issue.
- Mobility restrictions for male and some female scientists who cannot freely travel abroad for scientific events, even if they have a deferral from mobilisation.
- Problems with scientific mentoring and supervision.

After graduating, and having defended their thesis, some young scientists report limited or only part-time employment opportunities. For example, some may be hired for only 25% of a full working day and for as long as six months.

Some of these issues are not directly related to the war; they existed prior to its onset but have since become more pronounced.

The focus group participants were sceptical about legislative initiatives aimed at reforming the scientific sector in Ukraine. They emphasised that these initiatives 'are being introduced chaotically and unpredictably. Those who entered graduate school with some requirements, a year later they were changed, and next year they are different again' and that 'legislative initiatives are somehow not encouraging'. The participants also voiced dissatisfaction with the limited involvement of young Ukrainian scientists in key government decisions. At the same time, the focus group participants agreed that, compared to the situation 10-15 years ago, there were many more competitions, grants and projects available to young scientists in Ukraine.

Focus group 'The state of the staff at the displaced higher education institutions network of Ukraine'

The focus group took place on 23 December 2023 and had a duration of 128 minutes. It consisted of 12 participants, including 10 females and 2 males, with an average age of 45. The group comprised 2 Doctors of Science, 9 Ph.D. holders and one Ph.D. student. The participants were residents of Vinnytsia, Kyiv, Irshava, Mykolaiv, Zaporizhzhia, Ivano-Frankivsk, Germany and the UK. Representatives of HEIs have been relocated from Donetsk, Luhansk, Kherson, Berdyansk, Melitopol, Kramatorsk, Makiivka and Mariupol.

The staff at the displaced universities identified the following principal challenges they currently face:

- There is a perceived lack of an identifiable State policy on displaced universities. This has led to a sense of abandonment among staff members, who 'do not feel confident about tomorrow' and express concerns that 'motivation among teachers has markedly diminished'. They feel as though they are 'in a waiting mode', not particularly encouraged by 'sometimes incomprehensible reforms' that are 'accompanied by ominous messages that tomorrow may bring even greater challenges – particularly for displaced universities'. This highlights the importance of clear, concrete policies to remedy the position of displaced universities and HEIs, to account for their difficulties in practical ways, and to communicate those strategies clearly to those affected.
- The loss of material and technical resources can result in the need to rebuild from scratch. Individuals affected by this situation have often lost everything. Many have had to move twice already, disrupting their attempts to settle down.
- Lack of, or shortage of, premises to accommodate relocated universities is accompanied by bureaucratic difficulties with rental arrangements.
- The government's engagement with staff members left them with the sense that the process had not been meaningful and lacked genuine consideration

of the opinions of the displaced universities' staff. There is a perception among scientific researchers that government initiatives do not take into account the fact that there are displaced universities: 'take a look at the Strategy for Higher Education Development — there is no mention of displaced universities at all. We have repeatedly submitted proposals, yet it only seems to be a simulation of openness and of a participatory approach';[132] 'Despite gathering the representatives of displaced universities, as well as others for public discussion, no one was going to take them into account. They just talked, and that was it.'

> *Our projects were aimed at local, regional needs. Now, after moving, everything changed. Some individuals have to write a dissertation on a completely new topic.*

- There are security concerns for teachers and students in occupied territories, given systematic attempts to identify teachers and students and force them to cooperate, while applying pressure on relatives or seizing their property.[133]
- The third mission (activities beyond traditional teaching and research missions) of displaced universities involves relocating not only students but also their entire families. The role of the professor is not limited to teaching but also includes providing students with unlimited advisory support, which can sometimes resemble that of a 24/7 call centre.
- The particularities of the situation of displaced Ukrainian universities have resulted in unequal conditions: 'No other universities can compete with us in terms of the number of teachers and students who are IDPs, i.e. those who need to be supported on a daily basis.'
- Lack of funds for rent and other expenses related to displacement is a significant issue. Teachers are forced to seek assistance from social services, which can be a difficult process which leaves substantial feelings of resentment, especially for those having dedicated many years to their profession.
- There is a detachment from the local context: 'Our projects were aimed at local, regional needs. Now, after moving, everything changed. Some individuals have to write a dissertation on a completely new topic.'
- Loss of scientific developments and source base: 'There can be no unified requirements. No one takes into account that I left my unfinished dissertation in occupied Melitopol. I am expected to deliver the same result as those who continue to work at their original places'; 'I still have a significant library in Mariupol. When I left Makiivka, I managed to take 30 boxes of literature. I really miss them now.'
- Psychological strain: 'We must take pride in carrying the title of displaced people, as we continue to strive despite the challenges. Please respect us not only for our professional qualifications but also for preserving our identity and having relocated our children twice. Behind us, there are not just accomplishments but also numerous coffins and tears.'; 'Packing up and leaving forever within a mere 24 hours is incredibly difficult.'

Of some contextual relevance to these answers is the observation of the NAS of Ukraine that the government authorities, when implementing specific laws in relation to education, do not always differentiate between the staff whose institutions have not been displaced and those whose institutions have been. Frequently, two or more displaced institutions are merged, having substantial practical impacts, and often students in one region do not want to follow the displaced institution by moving to another region.

Focus group 'Challenges and needs of Ukrainian scientists during the war, including gender-specific perspectives'

The focus group discussing the challenges and needs of scientists took place on 10 January 2024, at 18:30 Kyiv time and had a duration of 123 minutes. 19 female representatives attended the focus group, with an average age of 45 years. The participants included 13 Ph.D.s and 6 Doctors of Sciences from various disciplines, such as sociology, history, physics and mathematics, geology, pedagogy, museum studies, chemistry, ecology, materials science, tourism, veterinary medicine, bio-molecular biology and natural sciences. Given that all

132 This is factually accurate. The 'Strategic Plan of the Ministry of Education and Science of Ukraine (MOES)' contains no explicit strategy for displaced universities. Priority 6: Development of Science and Innovation, Operational Objective 6.2.1.2. speaks of "[b]uilding institutional capacity to support the innovation ecosystem and development of innovative potential in prioritized sectors of Ukraine." There is nothing else of relevance to displaced universities. Available at: https://mon.gov.ua/en/the-strategic-action-plan-of-the-moes-by-2027.

133 Available at: https://www.amnesty.org/en/wp-content/uploads/2024/10/Public-statement-Teachers-Ukraine-1.pdf; and https://www.amnesty.org/en/latest/news/2024/10/ukraine-russia-teachers-in-russian-occupied-territories-coerced-to-teach-russian-curriculum-through-threats-and-violence/

of the representatives of this focus group were female, some of the discussion topics were gender-specific.

The following list summarises the issues discussed in the focus group:

- In general, respondents abroad highlighted challenges in building professional relationships with new colleagues, which affected their work efficiency. It was also difficult and time-consuming to integrate into new work teams and to change research topics. The situation was particularly challenging for female researchers who had to flee with their children and faced an increased workload related to nurturing them with insufficient networks of social support.
- Respondents pointed out a significant difference in the organisation of research processes in Ukraine and abroad, including in terms of research methods and approaches along with approaches to management of scientific projects. Interaction with new foreign research teams was often impeded by language and cultural barriers. Ukrainian scientists felt stereotyped by their foreign colleagues, for example, when they expressed surprise at their proficiency in foreign languages.
- The lack of institutional affiliation poses a significant challenge for Ukrainian scientists and educators, as foreign research institutions often require such affiliation as a prerequisite to provide Ukraine-specific support schemes. This requirement is, on the one hand, complicated by restrictions imposed by Ukrainian legislation concerning the permissible length of time away from a Ukrainian institution;[134] and, on the other, by a case-by-case approach to allowing researchers to keep the Ukrainian affiliation that differs across HEIs and research institutions.

> *In Ukraine, being a good scientist is more of an exception, not due to a lack of capable specialists, but rather a consequence of the imperfections of the scientific system.*

- Respondents emphasised the presence of inappropriate practices within scientific research in Ukraine, as well as unfair competition. These were advanced as reasons for the low efficiency of scientific activity in Ukraine, to the point where some scientists were relieved to have the opportunity to engage in scientific research abroad: 'In Ukraine, being a good scientist is more of an exception, not due to a lack of capable specialists, but rather a consequence of the imperfections of the scientific system.'
- Respondents also noted the lack of specialised support from the State and the risk of losing scientific potential. To address these issues, they suggested learning from Western colleagues on how to support scientists and prevent them from leaving academia.
- Scientists also have to deal with issues beyond their research which place a heavy burden on their time, such as customs clearance of scientific equipment and lack of training in writing grant applications.
- Personal issues can significantly impact a researcher's ability to work effectively. The stress caused by changes in residence and social environment, as well as concerns for the safety of family and friends and caring for children abroad, can lead to health problems and difficulty concentrating on work.
- Respondents also suggested that the ban on working with Russian scholarly sources[135] had reduced legitimate access to potentially valuable sources of scientific knowledge in their research domains and therefore compromised their research, and that, for some of them, the time had come to reconsider their long-term research plans.

Focus group 'Difficulties faced by Ukrainian scientists in attracting grants and opportunities for remote work during the war'

A focus group to discuss the challenges faced by Ukrainian scientists in securing grants and remote working opportunities during the war was held on 4 January 2024 and had a duration of 67 minutes. The group consisted of eight participants, including three males and five females, with an average age of 46 years. The participants included three Doctors of Sciences and five Ph.D.s from

134 This particular limitation is regulated by the following legislation: (1) The duration of internships abroad cannot exceed two years, as stipulated in Cabinet of Ministers of Ukraine, 2011, Питання навчання студентів та стажування (наукового стажування) аспірантів, ад'юнктів і докторантів, наукових і науково-педагогічних працівників у провідних вищих навчальних закладах та наукових установах за кордоном, (Resolution No. 411-2011), https://zakon.rada.gov.ua/laws/show/411-2011-%D0%BF#Text; (2) The possible duration of paid and unpaid vacations is addressed in The Ukrainian Law "On the Organization of Labor Relations Under Martial Law" No. 2136-20 (2023 Revision). (In Ukrainian.) https://zakon.rada.gov.ua/laws/show/2136-20#Text

135 More information can be found here: https://zakon.rada.gov.ua/laws/show/2798-IX#Text

various fields, including physics, history and archaeology, biology, radiophysics and radiobiology and social sciences. They represented scientific institutions and HEIs. The survey respondents reside in various parts of Ukraine, including Kyiv, Zhytomyr, Uman, Chernivtsi and Kharkiv. Additionally, one respondent was living in Czechia during the focus group.

Ukrainian scientists encounter several challenges when searching for remote positions, including the following:

- There should be increased emphasis on promoting remote grant opportunities and vacancies for scientists based in Ukraine. In some fields, such as physics, radiophysics and radiobiology, no such opportunities exist. Removal of physical presence as a condition for conferring grants, thereby removing obstacles for Ukrainian scientists, particularly scientists who are subject to travel restrictions, would increase flexibility for researchers and, potentially, increase competition for grants meaning more varied proposals from more diverse sources.
- The main source of information about grant and distance learning opportunities mainly comes from foreign peer-to-peer forums, direct mailings from scientific institutions and communities, and universities. Having prior working contacts and experience in applying for grant programs and distance learning positions is a significant advantage.
- To successfully attract remote grants or obtain a remote position, it is necessary to participate in scientific conferences that facilitate networking and contacts. Since the end of the COVID-19 pandemic, there has been a return to holding such scientific forums in person, but the participation of scientists based in Ukraine is currently limited for reasons already explored in this report. Hence, institutions worldwide should increasingly seek to offer hybrid participation.
- Additional financial support through remote grants is an essential component of the overall well-being of scientists in Ukraine. It enables them to continue their research without diverting their efforts to seek additional sources of income.
- Aligning rules and requirements for grant programs and accounting procedures in Ukraine and the EU could help overcome current internal challenges to securing foreign funding for Ukrainian research institutes and HEIs. Increasing the number of offices at research institutes and HEIs dedicated to attracting international grants and providing specialised training for staff concerned with financial reporting were considered good practice that should be further reinforced.

Mini-focus group 'Problems related to retaining scientific staff'

Three males participated in this mini-focus group, with an average age of 50, which had a duration of 84 minutes. The participants held the following degrees: Doctor of Chemical Sciences, Candidate of Chemical Sciences and Doctor of Biological Sciences. They served as Heads of two scientific institutions based in Kharkiv and Lviv. They discussed issues connected to retaining scientific staff. The key thoughts they expressed were:

> *For the cities close to the war zone, the loss of prospective students and the destruction of residential buildings leads to a reduction in the number of teachers and a decrease in research potential.*

- Ukraine must reverse the trend regarding State funding for science, prioritising science and scientific research and advice. Approval and funding for new State scientific and technical programs to support crucial sectors such as defence, agriculture or pharmaceuticals was underscored.
- Ukraine must actively promote scientific achievements in order to improve the status of scientists in Ukrainian society and facilitate the commercialisation of their research, meaning that systematic State support must also be provided.
- The State "Institute for Single Crystals" of the NAS of Ukraine (800 employees in total, including 360 researchers) has retained approximately 80% of its employees in Kharkiv. Up to 10% of the researchers are abroad in various statuses (including internships), while the remaining employees are IDPs working remotely. The Institute's ability to retain its staff is attributed to the consistent payment of salaries and the provision of support to employees during the first months of the full-scale invasion. This support included the use of a large bomb shelter, where staff stayed and received complimentary meals. Consequently, the Institute has been able to maintain its operations. In contrast, other scientific institutions in Kharkiv have experienced a significant attrition rate, with up to 80% of researchers departing the city. This has led to considerable uncertainty regarding the operational continuity of these institutions.
- For the cities close to the war zone (such as Dnipro, Kharkiv, Kherson and Zaporizhzhia), the loss of prospective students and the destruction of residential buildings has led to a reduction in

the number of teachers and a decrease in research potential. University professors in these cities are likely to seek employment abroad.

- Since February 2022, foreign donors redirected their focus to providing support to Ukrainian researchers who had fled the war, thereby limiting opportunities for grants allocated to research conducted within Ukraine.
- Another issue that requires attention is the loss of young scientists and students who have the potential to become contributors to scientific institutions. This phenomenon can be attributed to two main factors: first, the challenging security situation, and second, the inadequate remuneration for young researchers. It is worth noting that the issue of low salaries is not new, but has persisted for many years.
- Grant funding may be a useful tool to attract young specialists to science. However, in Ukraine, there are insufficient opportunities for accessing smaller grants that support research projects by teams of young scientists. Notably, the NRFU does not offer such programs at all.
- The NRFU's requirements for grant applications are often too onerous, which creates obstacles for scientists, particularly those facing difficulties due to the war. Indeed, NRFU requirements mean that even outstanding and well-known scientific researchers do not always qualify. Moreover, the NRFU frequently changes these requirements which makes it more difficult for scientific researchers to prepare for the next competition. It may be even more challenging to meet these requirements for those scientists who had to flee Ukraine. In addition, scientists who have remained in Ukraine and are willing to work but who face difficult circumstances due to the war may not have the opportunity to receive these grants.
- The process of obtaining permission to travel abroad for men and certain groups of women of military age can be complex, limited and, at times, unclear. The maximum permitted period of leave is usually 30 days; however, the V. N. Karazin Kharkiv National University imposes a limit of 21 days. In addition, during the COVID-19 pandemic, most high-level scientific conferences were held online. The inability to physically participate in international conferences has had a significant negative impact on scientists.
- The commercialisation of scientific research in Ukraine is impeded by legal obstacles, particularly regarding the role of State research institutions. For example, these institutions are prohibited from establishing start-ups, as the current legislation prevents them from selling patents. Moreover, the existing cooperation model, which relies on receiving royalties from patents, is unattractive to businesses.

Focus group 'The view of female scientists on the role of scientists in reconstruction'

The focus group 'The role of scientists in reconstruction' was held on 11 January 2024 and had a duration of 71 minutes. Seven female participants took part. The average age of the respondents was 47 years. The participants were two Doctors of Sciences and five Ph.D.s in various fields (mathematics, veterinary medicine, museum studies and linguistics) representing research institutes and HEIs. The respondents' geographical locations covered different regions of Ukraine, as well as Germany, Poland and Spain. The participants in this focus group expressed the following thoughts:

> *It is necessary to establish a mutually beneficial dialogue between the State and scientific researchers for the success of post-war recovery and reconstruction.*

- The part to be played by science in the post-war recovery and reconstruction process is crucial. Unfortunately, the role of scientists in Ukraine is often limited to inventions and contributions to scientific and technological progress. In contrast, according to the European experience of political decision-making presented during the focus group, there is a clear recommendation that every official decision should be accompanied by advice from an expert scientific researcher. Therefore, scientific expertise should be sought to enhance legal and policy deliberation and decision-making, at both the national and local levels, in order to accelerate Ukraine's recovery and reconstruction. It is critical that the State and politicians in Ukraine consult scientists, listen to their views and expertise and actively engage them in decision-making. To do so, it is necessary to establish a mutually beneficial dialogue between the State and scientists. The NAS of Ukraine has particularly emphasised the importance of the role of science in the post-war recovery and reconstruction process and that

official decisions should be accompanied by advice from scientific experts. Scientists can also play a crucial role in shaping a positive image of Ukraine and engaging in science diplomacy.

- Although the respondents expressed their willingness to participate in post-war recovery and reconstruction projects as scientists, there were uncertainties regarding the level of interest on the part of Ukrainian officials in their involvement. Scientists who are currently abroad may consider joining international structures engaged in post-war reconstruction and thus take part in international projects. According to some respondents, this option would be acceptable to them. It is suggested that involving the Ukrainian academic diaspora in reconstruction projects should be extensive, encompassing Ukrainian students abroad.

- Respondents noted the importance of trust in existing institutions and clear, transparent rules and processes for the effective involvement of scientists in post-war reconstruction projects in Ukraine – elements which, in their opinion, were currently insufficient. Therefore, it is crucial to invest in consolidating trust in institutions and creating a transparent legislative framework for post-war reconstruction.

- One of the key prerequisites for the effective participation of scientists in such projects is for these to include a suitable financial component. This aspect is crucial for incentivizing Ukrainian scientists to return to Ukraine and retaining qualified researchers after the war ends. Thus, attention and efforts should be focused on ensuring adequate financial support for the involvement of scientists in the post-war recovery and reconstruction process.

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6 Considerations for effectively improving the status of Ukrainian researchers, including through policy and program interventions

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The issues for consideration proposed below are based on an analysis of challenges identified through a comprehensive review of relevant literature and insights gathered from participants in six focus groups. Although during the research phase, the authors aligned with SDGs 4, 16 and 17, the proposals are formulated to align with SDG 16 on – 'Peace, Justice and Strong Institutions'. They also specifically focus on meeting the needs of female researchers in Ukraine and abroad, including those who have been displaced due to the ongoing war and those who have not relocated.

1. Improve funding for research and development in Ukraine:

- Gradually increase financial support for scientific activities from the State budget of Ukraine, in accordance with Article 48 of the Law of Ukraine "On Science and Scientific and Technical Activities", through a variety of channels (including both basic and grant funding for scientific institutions). This would result in an increase in the salaries of scientists, an enhancement of the quality of their working conditions and scientific results and an augmentation of the attractiveness of scientific careers, particularly for young scientists.
- In the period of transition until the implementation of appropriate remuneration standards for all scientists, it is recommended that priority be given to enhancing the financial attractiveness of the field for young scientists, particularly early career researchers.
- Funding for researchers and research through state prizes, scholarships and awards, and participation in national and international grant projects should support and demonstrate research excellence rather than compensating for the lack of core research funding.
- The NRFU should diversify its grant competition conditions by creating sub-competitions with less complex requirements and which are open

to scientists at different professional levels. Furthermore, it would be beneficial to explore alternative methods of certifying applicants' qualifications and experience.

- Expand free access to various databases and licensed software for Ukrainian scientists.
- Expand the opportunities for Ukrainian scientists to join international scientific professional communities and networks on favourable financial terms.

2. Enhancing grant support for Ukrainian scientists:

- Optimise the procedures for providing remote grants for the Ukrainian researchers and create special remote positions in foreign universities and research institutes to streamline application processes and reduce decision time.
- Reduce the level of bureaucratization and overregulation for grant competitions, in particular by digitising them, reducing the number of documents to be submitted and simplifying the content of the relevant forms (questionnaires).
- International partners should consider the expansion of grant programs for Ukrainian scientific institutions, with a view to facilitating research within Ukraine.
- Introduce remote (non-residential) employment opportunities for scientists based in Ukraine in positions at foreign research institutions. In order to facilitate this, it is necessary to overcome the obstacles related to tax residency status in the EU, which does not allow Ukrainian citizens who are not physically located in one of the EU countries to work in EU research institutions.
- Establish special centres at Ukrainian scientific institutions and higher education institutions responsible for supporting international grant applications (including remote ones), receipt, implementation and reporting.
- Ensure that the individuals entrusted with the responsibility of financial reporting on international grants possess the requisite competency level, particularly in the English language. Furthermore, it is essential to incorporate capacity-building on international accounting and financial reporting standards as an integral component of professional development activities.
- Utilise Ukrainian State grant initiatives to cover the costs of support staff services, including project managers and accountants.

3. Ensure secure living and working conditions for scientists:

- Equip scientific institutions with shelters and workspaces on their premises, ensuring the continuity of their operations during air raids, particularly in cities located near the border and in combat zones.
- Provide researchers who have been relocated from areas in close proximity to combat zones with suitable housing, social support and financial assistance for their families.
- Establish a distinct, streamlined and expedited process for Ukrainian scientists to access a range of state-provided social, medical and administrative services.
- Continue to strengthen legal frameworks to protect human rights, such as labour rights and freedom of expression, and these measures should also integrate analogous protections for scientists and scientific researchers.

4. Preserve connections of scholars who have left Ukraine and facilitate their return:

- Conditions should be created to facilitate the return of researchers to Ukraine and their subsequent professional reintegration. For example, a candidate who is currently employed at a foreign academic institution should be given favourable consideration for a relevant position at a Ukrainian research institute or university, given their possession of valuable foreign academic experience.
- Encourage foreign organisations which employ Ukrainian scientists to assist in research related to Ukraine and that international research groups be formed.
- Establish a transparent mechanism for maintaining Ukrainian affiliation for researchers who have departed Ukraine due to the war and are seeking employment in foreign academic institutions. This mechanism should be in accordance with the terms of relevant foreign programmes designed to support Ukrainian scientists.

5. Enhance the effectiveness of human resource management policies in research institutes and universities:

- Ensure inclusivity in the scientific environment based on characteristics such as gender, sexual orientation, age, religion, disabilities, ethnic origin or social background.
- Ensure non-termination of contracts for female researchers (scientists) in Ukrainian HEIs and research institutes that were forced to relocate abroad with their children, leading to the worsening of their social and financial conditions.
- Ensure adherence to guarantees in Article 57-1 of the Ukrainian Law "On Education" during martial law, securing researchers' and teachers' job stability.
- Facilitate the employment of researchers from outside Ukraine in Ukrainian scientific institutions with the relevant remote work agreement in place.
- Develop and implement a well-defined and unified mechanism with regard to martial law for male scientists of conscription age to ensure the possibility of travel abroad to attend scientific and other professional events (i.e. conferences, internships and research projects).
- Promote flexible working hours, electronic document management and workload reduction based on scientific achievements (for instance, balance the classroom-related, methodological and scientific workload of teachers).

6. Popularise science:

- Develop a diverse and inclusive national strategy for the popularisation of science.
- Systematically conduct communication campaigns to popularise science at national, regional and local levels. Such campaigns should involve scientists, science communicators and advocates, as well as representatives of educational institutions.
- Introduce a diversified system of State grants, public and private awards to support popular science projects.[136]
- Ensure media coverage of scientific topics (for example, information about research, interviews with scientists), allocating to them 5% to 10% of airtime on television and radio. To achieve this, there is a specific need to enhance the skills of journalists in ensuring coverage of cutting-edge scientific topics.
- Engage the Ukrainian scientific diaspora in the popularisation of science within Ukrainian media.

7. Support young scientists:

- Broaden the implementation of student-centred pedagogical approaches to ensure their application not only to master's students but also to Ph.D. students.
- Revise the normative regulation on preparing and defending Doctor of Philosophy and Doctor of Arts dissertations in order to consider the applicants' needs, in particular, eliminating excessive restrictions on the timeframe for preparing and defending dissertations and easing the formal requirements for dissertation defence council membership.
- Maximize the internationalisation of young scientists' activities, including their obligatory participation in bilateral scholarship programs that provide for partial co-financing from Ukraine.
- Provide a greater number of open grant competitions to be organised with a specific focus on young scientists.

8. Support staff of displaced universities and scientific research institutions:

- Consider the additional complexities and needs of the relocated universities and research institutes of the system of the NAS of Ukraine in the State policies on higher education and science in terms of funding, requirements for research results and the ratio of students to teachers.
- Consider enhancing efforts to inform research institutions about new regulations and available support mechanisms to ensure effective access and utilization during wartime.
- Actualise the work of the Council of Rectors of the temporarily relocated HEIs at the MESU, update the regulatory base on its activities, and give appropriate regard to their opinion and requests in the policy and operational work of the MESU.
- Simplify the legal and administrative procedures for ensuring access to local infrastructure for the relocated HEIs and scientific research institutes of the system of the NAS of Ukraine and sectoral academies of sciences.

136 For example, since 2022 the NAS of Ukraine has introduced the open competition and the award "For Popularization of Science".

- Grant providers should provide funding to cover relevant costs that they often do not consider: in project applications, take into account not only the relocated universities' and scientific research institutes' infrastructure, but also the leased infrastructure, and the possibility of implementing projects on the basis of centres for the collective use of scientific equipment.
- Prioritise displaced HEIs in research competitions and conduct separate competitions focusing on topics relevant to the needs of their respective territories of origin.
- Introduce targeted international programs to support HEIs, scientific research institutes and their networks.

Steps towards scientists' effective engagement in the recovery and reconstruction of the country and promoting sustainable development:

- Develop and approve a national program/strategy for the popularisation of science.
- Emphasise the role of science for the successful post-war recovery and reconstruction of Ukraine. This role should extend beyond scientific inventions, including a role for experts in decision-making for reconstruction projects and contributing to a positive international image through science diplomacy.
- Engage research teams involving foreign scientists and representatives of the Ukrainian scientific diaspora, drawing on their experience in foreign institutions to provide expertise within the framework of post-war recovery and reconstruction projects in Ukraine.
- Enhance the system of approving and implementing State scientific and technical programs in collaboration with research institutions and businesses within the framework of public-private partnerships, with a particular focus on areas that are critical for the reconstruction and sustainable development of Ukraine.
- Address the existing practice among key policymakers in Ukraine of deliberately avoiding the consideration of extensive scientific expertise at every stage of development and implementation of management decisions.
- Promote systematic and coordinated work of public authorities, scientific institutions and HEIs of Ukraine with international partners to highlight the state of science, and its needs, during martial law, in order to build partnerships, increase the level of trust and attract funding for future post-war recovery projects.

The research findings also suggest a general awareness of the need to improve data collection and analysis methods, which are crucial for more effective policymaking processes. Furthermore, the results highlight the importance of adopting forward-thinking approaches to enable policymakers to make more informed decisions reflecting the complexities of the issues at hand.

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Resilient Minds

The unseen struggles of scientists in wartime Ukraine

This report addresses an understudied topic, namely the impact of the war on Ukrainian scientists, university educational staff, scientific workers and young researchers (with a general focus on scientists). The document identifies the principal challenges and proposes issues for consideration in order to improve their situation and well-being. These findings are based on an analysis of legislative and policy frameworks, available research and data, as well as on the insights from a series of focus group discussions with Ukrainian scientists conducted in December 2023 and January 2024.

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