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# LESSONS LEARNED FOR THE INTERNATIONAL COMMUNITY ABOUT THE IMPACT OF THE CRISIS OF WAR ON SCIENCE IN UKRAINE\*

Let us begin with the word, “*crisis*”. The first thing to understand about the impact of the illegal, unprovoked, immoral, and criminal war of Russia on Ukraine is that *there is not just one crisis, the war*. Instead, the *crisis of the war* weighs like a nightmare on top of other, long-term, pre-existing crises in Ukraine, including those in the sphere of science and higher education.

When we talk about science and higher education in Ukraine, we are not talking about a homogeneous, coherent, stable system. The transition from the Soviet science system toward Western models has been more difficult and conflict-ridden in Ukraine, and far more drawn out, than anywhere else. With war, this impasse has acquired increased urgency for Ukraine to move decisively beyond it, and there are new signs that it may indeed be possible. More about that below.

Another thing about crisis is that we need to understand that *crisis is often an opportunity for change*. As the English theologian and historian **Thomas Fuller** wrote nearly six centuries ago, the darkest hour is often just before dawn. In the lexicon of the “SWOT” (Strengths, Weaknesses, Opportunities, and Threats) strategic analysis paradigm, *crisis is the “T” – the threat*. Crisis is disruptive by its nature, but in creating urgency for action by bringing underlying weaknesses to a head, it can be a very constructive force as well, by requiring new ways of thinking, collaborating, organizing, and acting.

In fact, the internal crises in the Ukrainian science system have been on slow burn for many years. The earliest crisis was emigration. Here, I have in mind the massive emigration of scientists, particularly young scientists, in the years between

1991 and 2022. During that period, approximately one-half of the younger echelon of the Ukrainian scientific workforce, about 200,000 people, left Ukraine<sup>1</sup>. They went elsewhere not because of war or social unrest, but in search of better opportunities, of which there were many – in places like Germany, Israel, Japan, and even, reportedly, China.

These countries’ gain was Ukraine’s loss, although it is true that in almost all scientific migrations, there are constructive feedback loops between the scientific diaspora and the home country that develop. But the damage to Ukraine’s research enterprise was dramatic. It created a serious age gap between students and junior researchers at one end, and senior scientists at the other. When such anomalies develop, there is cause for concern about the sustainability of high-quality research as the age spectrum shifts to the “right” – i.e., as the older generation moves on.

In this context, we can also better understand the impact of the more recent emigration since February 24, 2022. According to estimates I have seen, the volume of this cohort of scientific emigrants was approximately one order of magnitude *smaller* than the pre-war level. By now, there exist many worthy initiatives to place these emigrants in positions abroad, in principle temporarily, but we know that at least half of them will not return to Ukraine. Yet we in the international community must understand, by the same token, that more than 80% of Ukraine’s scientists have remained in Ukraine, and until now there has been preciously scant attention to their livelihood, not to mention their ability to function as part of the global scientific community.

\* Adapted from a presentation at the 2nd Conference on the Ukraine Crisis: One Year of War in Ukraine, Exploring the Impact on the Science Sector and Supporting Initiatives (March 20, 2023), organized by the International Science Council (ISC) and the All-European Academies (ALLEA). The session in which this talk was given focused generically about responses to severe crisis in the sciences and arts in various countries in an effort to better understand how the international community is responding to the crisis of war in Ukraine.

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<sup>1</sup> According to the Ukrainian science policy expert and reform advocate Dr. **Nataliya Shulga**, based on official Ukrainian statistics.

The second challenge of post-independence Ukraine was the institutional structure of Ukrainian science and higher education, the inevitable legacy of the Soviet science system. In the Soviet Union, the most important scientific research was done in enormous academies of sciences with hundreds of vertically organized institutes, while universities were in almost all cases reduced to pedagogical institutions. This system worked reasonably well in the Soviet command-economy system, albeit very inefficiently in comparison with advanced industrial countries' standards. It was poorly suited, however, to transition to a knowledge economy needed to meet the global competitive challenges of the twenty-first century and to educate the next generation of Ukraine's scientists and engineers, the missing age cohort, and prepare them for its challenges.

In all post-Soviet countries, both those that had been part of the USSR as well as others, each country dealt with these organizational anomalies, at peace, in its own way. Some dramatically reduced the roles of the academies, some less so; competitive research-grant agencies were established and funded; and serious efforts were made to reintegrate university-based research and education so as to provide students, from their first years in higher education, the opportunity to learn from and work with teachers who were also top researchers in their fields as in modern research universities abroad, with modern instrumentation and equipment.

In Ukraine, however, for a variety of reasons, the old system remained intact because of entrenched interests and weak government. Efforts at the kind of reform undertaken by other post-Soviet countries, to a greater or lesser degree, were paralyzed for many years. Since the 2014 Ukrainian Revolution of Dignity, however, modest progress was made to modernize the system and bring it more into line with world standards...until the Russian invasion on February 24th, 2022.

The third underlying crisis to mention here was the legacy of corruption, which, to be fair, was far greater in areas other than in science. Yet for the international community, the long, sad history of corruption in post-independence Ukraine became stuck in the minds of those who might otherwise help Ukraine with material resources, especially in terms of willingness to send money into the country. And with a country actively at war, this reluctance only grew. In my view, however, this caution in its most extreme forms was misplaced.

There are indeed secure, accountable, and responsible ways to send financial and other support to scientists in Ukraine and it has been done for many years. As Chief Operating Officer of George Soros's International Science Foundation (1993-1995) and Founding President of CRDF Global (1995-2004), I personally oversaw programs that provided literally hundreds of millions of dollars of such support to Ukraine and other former Soviet countries. And this is not even to mention the enormous programs to prevent proliferation of weapons of mass destruction, such as the U.S. Nunn-Lugar program and the multilateral International Science and Technology Center (ISTC) and Science and Technology Center Ukraine (STCU).

All these programs adopted a disarmingly (please excuse the pun) simple approach that ensured complete accountability, security, and effectiveness. Briefly, instead of sending money through institutions, it is sent directly to specially created, secure bank accounts of the individual recipients. Equipment is purchased by the funders and then donated as gifts to the research teams. This approach, somewhat unorthodox from the standard methods of managing grant funds, was so secure that

even major private foundations and corporations sent tens of millions of dollars, if not more, to researchers in these countries with complete confidence. This channel, in various forms, is still available today. We should make use of it so long as reservations about the more conventional methods hinder action in this emergency situation.

These *three major challenges – brain drain, unresolved institutional conflicts, and the legacy of corruption* – each of them a crisis on its own merits, were all in place on February 23, 2022. On the next day, however, they became not merely a crisis, but an existential issue for Ukrainian science and for Ukraine's long-term survival as an independent, sovereign country. It is now painfully clear that the system must change.

This is why we in the international community must understand that helping science in Ukraine is not, or is no longer, primarily about helping the refugees, who have justly benefited from the outpouring of support and generosity of many individuals and institutions, nor is it only about short-term emergency financial support to scientists remaining in Ukraine. It is about assistance to Ukraine with the goal of doing so in such a way that promotes the integration of Ukrainian science into the global scientific community, that brings the management of Ukrainian science up to world (specifically, European) standards, that makes Ukraine a place to which refugees will want to return in order to do good science. Additionally, it is a matter of overcoming our own institutional inertia to do what the situation demands.

Having painted such a dark picture of the internal crises of science and higher education in Ukraine, there are now encouraging signs that internal developments may make real progress and resolution possible.

The institutional paralysis I've described in this space was aggravated, as I've argued above, by *weak leadership*. "Weak leadership" may be too mild a term. The Ukrainian Minister of Education and Science from 2020 until March 20, 2023, led by *Serhiy Sharklet*, who was widely held to be deeply incompetent, was replaced by *Oksen Lisovyi*, who returned from the front as an airborne assault soldier to take on his new post. Presumably Lisovyi, with his experience in battle, understands the importance of both strategy and decisive action. As the nation's new leader of policy in science and education, we may hope that the previous logjams and conflicts – stoked, according to reports, at a recent high-level meeting by his predecessor – will finally be addressed in a constructive way.

As the title of this essay begins with "**lessons learned**", I will now turn to trying to summarize the ones that are most salient for me.

First and foremost, **listen and learn**. Understand that despite your experience or scholarship or high office, you really do not know what is going on in the country. What you see are the external symptoms, not the causes, nor the real substance. Take the time to have as many deep conversations as you can with Ukrainian scientists and officials; solicit different opinions; develop a deep understanding of the country's history and culture; and by all means, do not lose focus on your actions' impact on the country's long-term future.

Secondly, **be strategic**. In Ukraine and abroad, there is a vigorous discussion about the enormous cost of repairing the damage caused by Russia's invasion and murderous assault on the nation's infrastructure. But the most important damage is to the people who, unlike buildings, can decide to go elsewhere or change their profession. The costs of addressing the needs of the

people, the scientists and students remaining in Ukraine, the vast majority of that workforce, are infinitesimal as compared with the costs of physical reconstruction. Call it Ukraine's "human capital", if you like (I don't).

Human capital – the people, the scientists, the students – must come before brick-and-mortar infrastructure. It's really very simple and it goes like this: If you don't take early measures to sustain and stabilize the people of science and higher education, and they predictably go elsewhere either geographically or vocationally, the physical repairs for which you pay dearly will have nobody to use them for their intended purpose.

Third, **do not let your immediate response to the first crisis you see** – in this case, I would argue, **emigration – become your permanent focus**. It is virtuous and necessary, but only the beginning.

Fourth, by all means, **do not imagine that the "next phase" of support, whatever it may be, must await the end of the precipitating external crisis** – whether it's a war, a flood, a coup, a terrorist attack, or something else. For one thing, the "crisis" may never be over, or it will take far longer to be over than you can imagine. For another thing, by the time it ends, it may well be too late to do anything about it, because by that time, new realities may have taken hold that may not be conducive to your goals and efforts. *Do not confuse the long-term with the short- and medium-term*, as **Lord Keynes** said in his famous aphorism.

Let me give one specific, highly irksome, example. I have heard many supposedly knowledgeable people, including prominent scientists, dismissively say that it's impossible to do scientific research now in Ukraine, implying that the correct focus is elsewhere, on refugees, and to integrate them into other countries' scientific enterprises. In my view, that is cherry-picking at its scientific worst and simply could not be further from the truth. Yes, there has been extensive damage, destruction, and death; yes, many scientists and students remaining in Ukraine are at the front and not at their laboratory benches; and yes, those who stay in Ukraine have urgent worries about basic survival, and some have given their lives.

But what these wise sages do not understand or imagine from the comfort of their own armchairs is that life goes on in Ukraine. Those scientists who are not at war or in exile continue to read the international literature when they have electricity and internet; they go to their laboratories if they are at all intact and work on what they can; they participate in scientific seminars and even research projects by Zoom; they publish scientific papers<sup>2</sup>. Most of all, they aspire to be members of the global scientific community. If you assume that their situation is hopeless because they cannot do Nobel-grade research at this immediate moment, you are doing them great harm and doing world science irreparable damage.

Fifth, **fewer words and more action**, if you please. By now, one year later, if the meetings, workshops, speeches, analyses, and utterances are not directly tied to organizing and implementing thoughtful initiatives or programs of support developed together with your Ukrainian colleagues, then in my opinion they only prolong the crisis and condemn us to forever being spectators and not actors.

Sixth, **be prepared to take risks**. Yes, it is certainly possible to get money and resources for science and education, lots of it, into Ukraine if you're smart about it. You can and should experiment with programmatic and organizational approaches. Pilot projects

can be very effective in helping you understand what works, what doesn't, and what can be fixed to make it work better. And if you are wise enough to design such initiatives together with your Ukrainian partners and not unilaterally, not only will the projects have better chance of success, but also when they don't work, both sides will live, learn, and build trust, and then try something different again.

Seventh, for a country in crisis, while science, higher education, and technological innovation are critical for the country's future, they are low on the immediate to-do list of world governments and institutions. Do not wait for them to act; they will focus on the "big-ticket" items, such as winning the war and providing massive humanitarian relief. The case of science and higher education in Ukraine has been no exception. That is why the initiatives of smaller, nongovernmental entities – research agencies, foundations, universities, professional associations, and individuals – are so critical to bridge the gap and set examples of what can and should be done on larger scales. **Ukrainian science, and especially Ukrainian scientists, cannot afford to wait for a Marshall Plan, if one ever appears, to make personal decisions about future career paths**. The example of the immediate post-1991 period in the former Soviet Union is instructive here. Research funding across the board disappeared almost overnight. While there was much public concern, especially abroad, about a "brain drain" of scientists to other countries, far greater by volume was the "internal emigration" of researchers, professors, and students to often menial work – driving buses and taxis, guarding warehouses – to make ends meet. In that case, major international programs, both public and private, quickly intervened with direct financial support to keep the most productive scientists, as well as those involved in work on weapons of mass destruction, engaged in research. Many of those scientists who did not receive this support, sadly, were lost to science. The scale of the "human capital" issue in Ukrainian science is more modest, but the dynamics are the same.

Finally, and I would say most importantly, **the best antidote for scientists in a country in crisis is...that's right, more science!** Opportunities for international scientific cooperation – for example, serving as expert reviewers for competitive research proposals, virtual engagement in foreign projects, access to scientific journals and replacement parts for damaged equipment – all these are within easy reach of the international scientific community. We must understand that our job is not only to provide material support, but also to provide hope through our deeds and not only our words.

It is a noble thing to think that when we help scientists, we are saving science itself, regardless of where it takes place. But in truth, science, the advancement of knowledge, while a value in itself, is also one of the most powerful tools at our disposal to promote the quality of life, solve increasingly complex problems, and strengthen national security, in concert with its inseparable companions, education and innovation. All the more so is this true in today's Ukraine, which, when victorious in its current struggle, must not only recover, but also ensure its long-term survival as an independent, sovereign, and economically vibrant member of the world community.

As a Ukrainian friend and colleague likes to say, **"there is no successful country in the world today that does not have good education and good science"**.

Слава Україні!!! ■

<sup>2</sup> See the interesting article on the Ukrainian Journal of Physics in **Michael Schirber**, "Publishing science in a war zone," Physics, March 24, 2023, DOI: 10.1103/Physics.16.49.