

EDITORIAL

When war disrupts science: the Sudanese case and its larger implications

EMAN SOBH^{1,2,3}, AJIBOLA F. OLADEJO³, EUNICE F. FONDZE-FOMBELE⁴, BRIGHT I. NWARU^{3,5}

AFFILIATIONS:

¹Chest Diseases Department, Faculty of Medicine for Girls, Al-Azhar University, Cairo, Egypt

²Respiratory Therapy Department, College of Medical Rehabilitation Sciences, Taibah University, Medinah, Saudi Arabia

³African Science Frontiers Initiatives

⁴Department of English and Cultural Studies, University of Buea, Cameroon

⁵Krefting Research Centre, Institute of Medicine, University of Gothenburg, Sweden

CORRESPONDENCE:

Dr. Eman Sobh
Chest Diseases Department,
Faculty of Medicine for Girls, Al-Azhar University, Cairo, Egypt
Email: emansobh2012@gmail.com

INTRODUCTION

Scientific research contributes to societal development by finding solutions to local and global challenges¹. Africa faces many challenges that affect science and research, including poor infrastructure and lack of funding. The various regional, local, and national conflicts and war ongoing in several places in the continent have added another layer to these challenges. The consequence is that research and innovation are largely affected: in some places they come to a standstill, while in other places, progress becomes chronically slow. Conflicts and wars lead to destruction of infrastructure, displacement of scientists, and a surge in brain drain. The cost does not end there. There is always an attendant loss of human and physical capital, as well as diminished international collaboration².

This editorial highlights two papers published in the current issue of the journal, which presented the realities of the impact of the ongoing Sudanese war on the scientific community, education, and research infrastructures in Sudan. First, highlighting the impact of wars on science from a global perspective, commentary is made on the impact of the Sudanese war on scientists who remained in the country while the war rages and the impact on scientists who were displaced and are taking refuge in other African countries and around the world. The interventional support and solidarity provided by the African Science Frontiers Initiatives (ASFI) to help the affected scientists cushion the negative impact of the war and create a coping and recovery pathway are also described. A call is made to other organizations to replicate the ASFI example. The editorial concludes by offering suggestions on the way forward through this largely avoidable conflict that has continuously engulfed a large path of society, at the end comes to no one's interest.

When war disrupts science: a global perspective

From a global context, an immediate example of the direct and indirect impact of conflicts and wars on science, scientific community, and research is the case of Ukraine. Many Ukrainian research institutions have been destroyed and thousands of scientists displaced, internally and externally³. Although it is impossible to quantify the full impact of the ongoing war, available data suggest that by late 2022, less than nine months into the war, at least 18.5% of Ukrainian scientists had fled the country. Of the scientists who remained in the country, at least 15% had changed their profession, up to 23.5% no longer had access to required resources for their research, and at least 20.8% could not have any physical access to their institutions or research infrastructures⁴. Although the current

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and future impact of the war on science and research in the country is yet to be ascertained, the country's scientific output has drastically decreased, by up to 10%². Regaining their pre-war position can only be imagined, both in the short- and long-term. In the absence of an active science, it is clear that the society suffers in all ramifications.

When war disrupts science: the case of Sudan

Sudan is currently undergoing a situation similar to Ukraine with the ongoing civil war, which started in April 2023, involving the Sudanese Armed Forces and paramilitary groups. The war has led to over 230,000 deaths, over 33,000 injuries, internally displaced over 10.9 million persons, and over 2.31 million persons have fled the country^{5,6}. Within the first three weeks of the war progresses, there is annual 20.3% decline in GDP, unemployment rate reached 58%, inflation rate 200%, the currency lost 50% of its value, the properties and goods has been looted or damaged reducing population access to services and goods. Most health properties are nonfunctioning, over half of the population is in need of humanitarian aid and 750,000 are facing starvation^{7,8}.

The country's economy fell by more than a third, currently estimated to have caused up to \$9 billion (about \$100 million per day) in economic loss. Additionally, the looting of properties and goods resulting from the conflict is valued at \$40 billion. The currency exchange rate has become a shadow of itself, with the entire economy currently at a standstill. In addition to a 40% decline, the economy is expected to further decline up to 28% in 2024. The losses - in life, material property, and economy - paints a bleak picture for a country that was barely recovered from recent public protests⁹.

Beyond its impact on the economy and political system, the Sudanese war has taken a big toll on science and the community of scientists in the country. Like the situation in Ukraine, many Sudanese scientists have been displaced, within and without the country, many seeking refuge in other countries in Africa, Arab countries, and other countries around the world. According to the Sudanese National Academy of Sciences, the number of researchers and scientists leaving the country are in their thousands. The

scientists search for a safer environment and/or seek positions in institutions in other countries. Many of them are still searching for institutions to accept them to continue their work and study. Those remaining in the country, particularly in the areas most affected by the conflict, have been unable to continue their research as many institutions are either destroyed or closed down¹⁰. Most international collaborations are lost or suspended. Most of the scientists remaining in the country do not receive salaries, increasing the national unemployment pool¹¹. Many of them face troubles in receiving visas to attend international events. The loss of talented manpower affects the educational process and other services in the country, exaggerating the existing worrisome trends in brain drain. Although most institutions in the affected areas adapted online platforms for their academic activities, the internet services unfortunately are poor, unstable or have been destroyed.

The ongoing conflict and its attendant destruction have led to a short-lived post-COVID recovery, adding a double tragedy to a country that has historically known several internal conflicts¹². Nevertheless, the story of the impact of the war on science and scientists cannot be better told by anyone else than scientists themselves. It is in this context that the two papers published in the current issue of ASFIRJ by Alamin and colleagues¹³ and Omer and colleagues¹⁴. are worth the read of every member of the society - scientists and non-scientists alike. Telling the story of the war from the perspectives of its impact on scientists who remained in the country, on one hand, and scientists who took refuge in other countries, on the other hand, the two papers highlight a significant setback to science from a national perspective and the great ordeal a generation of scientists faces for a long time running. Clearly, carving a pathway that will bring full recovery for science and scientists in Sudan to a pre-war condition is not a trivial task, if at all that can be achieved in the current generation. The consequence is that the society suffers as its critical "eye" and "hand" have been blinded and broken, respectively.

Impact of the Sudanese war on internally displaced scientists

Presenting the account of the impact of the war on science and scientists from the perspectives of

scientists who remained in Sudan amidst the war, Alamin and colleagues told of an untold hardship that has confronted the scientific community and university education¹³. For instance, the destruction of several universities, the closure of many others, and the displacement of students who studied in those institutions means that the future of such a generation of students is jeopardized. The destruction affected study materials, such as textbooks and technological resources, hampering the learning process. Despite the precarious situation and as a result of the economic downturn, the government significantly reduced the salaries of teachers and lecturers, which put a heavy burden on them amidst the continuously rising inflation. The psychological accounts resulting from human right violations, forced or inevitable separation from families, violent death of loved ones and colleagues, and uncounted physical and psychological torture are horrific. The resultant trauma, depression, loneliness, and anxiety has affected the mental health of many scientists. The list is endless, and it is not possible to imagine how scientists and science can thrive in such a situation and environment and still fulfill its mandate for society.

Impact of the Sudanese war on externally displaced scientists

Omer and colleagues narrated the impact of the war on Sudanese scientists who fled or were displaced to other countries¹⁴. They highlighted a myriad of challenges, including forced displacement; loss of research infrastructure, resources to conduct research, and the professional and social network that facilitated their work while in Sudan; different layers of career disruptions; financial setbacks; emotional and psychological struggles; and difficulty adapting to a new country. However, they also saw some lights through the dark tunnel: as they said, the “displacement has increased exposure to new cultural and social contexts that helped foster research perspectives and innovation for some scientists. Despite hardships, this adversity has strengthened resilience and opened new possibilities for advancing scientific research¹⁴”

Recognizing the herculean task required to rebuild the country, scientific infrastructure, and restore pre-war cohesion within the scientific community, they also

offered candid short- to long-term strategies to help support displaced Sudanese scientists from the global scientific community and the countries the displaced scientists are currently residing. Such immediate interventions may include: (1) initiation of processes by host countries and institutions that facilitate smooth transition and adaptation of displaced scientists to local situations; (2) policies at the host countries and institutions that foster collaborations and networking between the host scientists and displaced Sudanese scientists; (3) creation of an alliance of displaced scientists’ platform that fosters a professional and social community for scientists similarly displaced as a result of conflicts from around the world; (4) creation of opportunities for capacity building and continuous training of displaced scientists¹⁴. These are excellent possible interventions to implement in order to minimize the effect of the war on Sudanese scientists or other scientists affected by similar conflicts and are taking refuge in foreign countries. However, achieving the success of these interventions will require a global coordinated effort to drive them.

Impact of Sudanese war on science and scientists: the ASFI solidarity

Undoubtedly, the ongoing war is creating challenging scenarios for the Sudanese scientific community that portend complex policy implications – within Sudan and across Africa and beyond. While the world struggles to contend with the effect of various conflicts going on in different communities and countries, the dimension of the impact on the scientific community aggravates an already precarious situation¹⁴. Nevertheless, riddance of hope for Sudanese scientists requires all hands to be on deck. No amount of support at this stage will be too little or too much. Affected scientists, home and abroad, need some succor and support that will provide both emotional and psychological boost, as well as a platform where they can connect with other colleagues far and wide. One way this can be done is to encourage institutions not affected by the war in Sudan, institutions in other countries in Africa and beyond to develop supportive programs, online platforms, visiting programs, access to electronic libraries and computing resources, and where possible, research grants¹⁴. In consideration of these potential lines of support, ASFI, early in 2024, widely sent out an invitation to Sudanese scientists,

home and abroad, to join its platform, offering them free membership and free entrance to all capacity building training offered by the organization in 2024.

The overarching goal of the ASFI solidarity call was to provide a platform for Sudanese scientists to be involved in a community that will keep them engaged during the course of the war. It is the utmost belief of ASFI that scientists are the watchmen of society; thus, are at the forefront of the development of any society. A society where scientists are displaced from their work leaves a state of hopelessness both for the scientists and the society. Therefore, at no other time do Sudanese scientists need the solidarity of comrades across Africa and the world more than at this time they face uncountable uncertainties. The invitation ASFI sent out received and continues to receive a positive response. Through this intervention, more than 500 Sudanese scientists have joined ASFI, of which at least 400 have participated in at least one course offered by ASFI during 2024. Those who have joined have been integrated into various programs and projects run by the organization, including involvement in various ongoing research projects, mentoring activities, and various other networking and collaboration opportunities. This process of integration has resulted in revitalization of many scientists who were affected by the war. Many have expressed their gratitude for the integration. There is hope in the air as many Sudanese scientists who have joined ASFI have been encouraged. The African-wide network ASFI provides is enriching their experience, connectivity, and ensuring that they have a sense of belonging, care and support from peers across the continent. All these activities are being undertaken only virtually, showing that distance is not a barrier. These measures have provided a platform for Sudanese scientists to be involved in a community that keeps them engaged, creating opportunities to interact, collaborate, and partner with other African scientists.

Impact of Sudanese war on science and scientists: call for action

Action is required from all sectors of society and across the globe to support Sudanese scientists during these trying times. Protecting scientists, researchers, and students is paramount for the survival of any nation. Despite the existing challenges, there is still a window for recovery. The support so far offered by ASFI has

shown that little temporary efforts can have the potential to yield encouraging results of recovery of affected scientists. Does it solve all the attendant challenges brought about by the war? Far from it, but it represents a beacon of hope. The scientific community, international science councils, universities, and research centers policymakers are encouraged to show their support. Sudanese students can be given admission to international educational institutions, scientists can be integrated into ongoing projects, physically or virtually, to continue their research work. Institutions can offer financial support and scholarships to Sudanese students. Reconstruction of destroyed institutions and research infrastructures can be made through donations from the scientific and industrial community. Academic institutions can host Sudanese academics who were displaced till the end of the crisis. This is not a time to stand aloof, but a time for action. Everyone is called into action.

CONCLUSION

Education is a fundamental human right; it is the only avenue through which scientists are trained and equipped for their work. There can be no meaningful societal development without an intentional contribution of science through impactful and quality research. Impactful and quality research requires the necessary infrastructure and environment to thrive. Any disruption to a conducive environment for research is a serious impediment to societal development and the progress of the scientific community. The papers by Alamin et al and Omer et al once again bring up the realities of the ugliness of war and conflicts, with devastating impacts that are not to anyone's interest. The war has caused much damage to the fabric of the society, properties, infrastructures, and intellectual capital, which has serious implications, not only for the current generation of Sudanese scientists but for many generations to come, born and unborn. Although the war still rages, rebuilding the society - properties and community cohesion - remains a long-term dream, internally and externally displaced scientists urgently need immediate short- to mid-term support. ASFI has demonstrated that little contributions can make a big difference in the life of many affected scientists. The provision of and access to social networks and vibrant community engagement with several researchers

across Africa is potent to curtail the issues of loneliness and isolation. We call on other non-governmental and not-for-profit organizations working within the landscape of science and research across Africa and globally to replicate the ASFI example. When all these efforts are put together, we believe that most affected Sudanese scientists, home and abroad, will be accommodated into a recovery intervention, at least temporarily.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

AUTHORS' CONTRIBUTIONS

BN conceived the idea for this editorial. ES made the initial draft with support and critical feedback from all authors. All authors approved the final version of the manuscript.

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