



THE PROBLEMS OF RESEARCH AND THE PLIGHT OF RESEARCHERS IN SOME DEVELOPING COUNTRIES: SUDAN AS AN EXAMPLE

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Abstract

Purpose: The purpose of this viewpoint paper is to review the past and current status of research and the problems facing research and researchers in developing countries, giving Sudan as an example.

Design/methodology/approach: The source of the material is published papers, data from reports in grey literature and personal experience of the author in research over the last 50 years.

Findings: A major problem is paucity or lack of funding by the government, the local non-governmental organizations (NGOs) and the private sector. Consequently many of the local health problems, particularly those affecting the poor, are not addressed properly. Most of the research in the past was between Sudanese and foreign research institutions, mainly in Europe. These were funded by the European Union or directly by a European country. This collaboration resulted in the development of infrastructure and the training of Sudanese scientists to take the lead in research on local problems. The Sudanese National Council for Research, with its specialized councils, played a major role in this. At present there is no effective national body entrusted with coordinating and funding research. With the recent sanctions imposed on Sudan, we have lost most external funding. Had it not been for some NGOs in Europe such as the Drugs for Neglected Diseases Initiative (DNDi), it would have been impossible to perform any meaningful research. Even if we secure local funds we are unable to buy equipment or reagents



simply because many firms are prohibited from supplying research reagents and equipment to Sudan as a result of sanctions imposed on the country. Because of the deteriorating situation of research and services, many Sudanese scientists are leaving the country. Other reasons for this exodus are discussed.

Keywords: Research problems, North–South South–South collaboration, Sudan, Effect of Sanctions, Brain drain

Paper type: Viewpoint paper

INTRODUCTION

Over the last few years Sudan has been facing problems in many fields of research including medical research. The country is also encountering problems in providing good quality health services, particularly to the poor. Many of these problems are attributable to sanctions imposed unjustly on the country. This article is a review of how sanctions imposed on us have adversely affected research and services in Sudan and the consequences of these sanctions. I give examples of how research was flourishing in selected institutions in the country and how this has been adversely affected by sanctions. Had it not been for some NGOs based abroad who came to our rescue, it would have been impossible to undertake meaningful research that particularly addresses the health problems of the poor marginalized communities. Other causes adversely affecting research and researchers in Sudan are described and discussed.

METHODOLOGY

The source of the material is published papers, data from reports in grey literature and personal experience of the author in research over the last 50 years

RESULTS AND DISCUSSION

North–South and South–South collaboration in health research

The last 15–20 years have witnessed an increase in collaboration in research between developed and developing countries. In this review several projects representing North–South and South–South collaboration are described and discussed. The North–South collaboration was between the University of Khartoum and several

academic institutions in Europe. The South–South collaboration was initiated and supported by the Drugs for Neglected Diseases Initiative (DNDi), an NGO based in Geneva. Most of the research supported by DNDi is in developing countries where neglected diseases are endemic. Health research, supported by DNDi in East Africa, is largely between African scientists.

THE START OF NORTH–SOUTH COLLABORATION: MSF HOLLAND

In 1990 MSF Holland initiated research and health services in Gedarif State by supporting a group of Sudanese scientists from the Faculty of Medicine and the National Public Health Laboratory to work in remote villages where visceral leishmaniasis (VL) was an important health problem. Working with the group from MSF Holland was E.E. Zijlstra, who was awarded his PhD degree on VL by the University of Amsterdam for his work in Gedarif State.

RURAL PARTS OF GEDARIF STATE IN 1989 WHEN WE STARTED WORKING ON VISCERAL LEISHMANIASIS

The inhabitants of the area were from different parts of Sudan, particularly Darfur. There were also Nigerians and some other tribes from West Africa. The roads were poor and during the rainy season the villages were completely isolated. The health services were poor. There were only two main hospitals: Gedarif and Hawata and a smaller rural hospital at Safawa village. Health centres and dressing stations were almost empty huts with very little in the way of diagnostics, treatment facilities or preventive measures. Drinking water was a problem. Most of the year the source of water was from the pools left after the Rahad River dries up or from Hafeers (man-made water bodies) where man and beast share the facility. Latrines were unknown in the area. There were no trained midwives and no anti-natal care facilities except in Gedarif and Hawata Hospitals. Only traditional birth attendants were practicing midwifery in the villages.

The main endemic diseases were malaria, VL (kala-azar) and leprosy. Kala-azar was rife. The drug Pentostam for treating kala-azar was only available in the hospitals. Travel to the hospitals costs money. Admission to the hospital, diagnosis and treatment were too expensive for the families. Parents lost income because they had to stay with

their sick children away from their jobs. A black market for Pentostam was flourishing and very expensive; it was sometimes just water sold as the drug. Parents would buy a few millilitres of the drug, which was too small to be effective, and inject the drug themselves because they could not afford to pay a nurse to do the job. Leprosy patients did not have access to diagnosis and treatment. They did not know that there are drugs for treating leprosy. In 1993 when the Institute of Endemic Diseases was established, we started our research on VL and post PKDL. We continued to be supported by MSF Holland. We felt obliged to render services to the community and not limit our work to research. We visited the area at least twice a year for periods of 4–6 weeks. Clinics were held under the shade of trees or in grass huts. Eventually MSF Holland established a centre in Um Kuraa village for the diagnosis and treatment of VL. Later, they established another centre at Kassab village.

Although our main base was Salala and Kooka villages, patients started coming from all over the state. We travelled to remote villages regularly to find new patients and follow up old ones. This work eventually resulted in collaboration between the Institute of Endemic Diseases, Amsterdam University and the Royal Tropical Institute. We had a grant from the European Union to do research on VL. Thus the work initiated by MSF Holland and later continued between the Institute of Endemic Diseases and the University of Amsterdam was the first North–South collaboration in research in the last two decades.

MSF Holland continued to work in Gedarif State until 2009. MSF France supported Professor Seyda EL Safi in her work on VL in Gedarif. MSF Switzerland is now providing services in Tabarakallah in Gedarif State.

NORTH–SOUTH COLLABORATION BETWEEN DENMARK AND SUDAN

The project covered the period from 1991 to 1999 and was supported by the Danish International Development Assistance (DANIDA, 1999). It covered two main health problems: malaria and leishmaniasis, two of the major health problems in Sudan. Senior scientists from both countries first met in Khartoum and agreed on the goals and objectives of the project. The main objectives were to gain an understanding of the epidemiology and host parasite interaction in these two diseases and to develop effective preventive and curative measures. A major objective

was to strengthen research capacities in both countries and to train Sudanese and Danish students in the fields of leishmaniasis and malaria. The institutions involved in the project in Sudan were the Institute of Endemic Diseases (IEND) and the Department of Biochemistry of the Faculty of Medicine, University of Khartoum. At the IEND several projects were initiated, with the active participation of both Sudanese and Danish scientists. As a result of this, eight Sudanese and six Danish students obtained their PhD degrees in immunology or molecular biology. Some of the Sudanese students returned to Sudan and continued their research through funds from TDR, Wellcome Trust and other sources. They have in turn trained other young Sudanese to Masters and PhD levels. Sixty-seven papers were published in reputable international journals in the fields of leishmaniasis and malaria.

The project on Malaria was largely between the Department of Biochemistry, Faculty of Medicine, University of Khartoum and the University of Copenhagen in collaboration with IEND. A modern laboratory was established in the Biochemistry Department. A field station in a village in a malaria-endemic area in Gedarif State was also established. Data on the village covered ten years and represents one of the most meticulously kept databases for biological samples in the world.

The Institute of Endemic Diseases has benefited from this collaboration through capacity building and training and was able to compete for and acquire funds from various international organizations (IEND, 2013).

Three problems had a negative impact on this project. The first was the termination of the project by the Danish Government due to human rights issues in Sudan. The second problem was that some of the trained Sudanese scientists did not return to Sudan. Thirdly, very little local funding was available and consisted mainly of the salaries of nationals and overheads.

COLLABORATIONS BETWEEN SUDAN AND BRITAIN

Professor M.E. Ibrahim of the Institute of Endemic Diseases collaborated with three distinguished scientists in Britain: Douglas Barker, Jennifer Blackwell and Dominic Kwiatkowski (MalariaGen, 2013).

This is what Professor Ibrahim wrote about that collaboration:

“Douglas Barker, Jennifer Blackwell and Dominic Kwiatkowski are three distinguished scientists and wonderful people from distinguished institutions with whom I was more than privileged to work.

The three belong more or less to generations that inherited the legacy of tropical medicine and worked on diseases of the developing world. The three had significantly impacted capacity building and training in our Institute of Endemic Diseases in various ways. Capacity building as a necessity in collaboration between unequal partners is often neglected in the spirit of mutuality. This was not the case here. Apart from hosting me in his laboratory over two academic years, Douglas donated his entire laboratory equipment to the IEND after retirement, and for years transferred journal subscriptions to Khartoum.

Jennifer Blackwell stepped in when she was at the top in the newly established prestigious Cambridge Research Institute, with her multi-dimensional involvement in leishmaniasis research. She introduced our group to the genetics of leishmaniasis and was instrumental in the making of Hiba Salah, her PhD student, a shining star in the IEND and internationally (IEND, 2013). As a result of the collaboration with Cambridge, Hiba Salah was awarded the Pfizer/Royal Society prize for her work on the genetics of visceral and post kala-azar dermal leishmaniasis.

Blackwell assisted several other young Sudanese scientists who went to her lab in Cambridge. Dominic took over from the level Blackwell had reached before she left for Australia. Dominic stuck his neck out against an unjustified trend of isolating science and scientists in Sudan. We learnt a great deal from Dominic’s exemplary leadership in science. Most prominently, the project we collaborated in has succeeded not only in science but in ethics, networking and capacity building. The way the project MalariaGen on malaria was launched and evolved is an exemplary example of how North–South collaboration should be (MalariaGen, 2013).

We utilized this resource and secured funding from the European Union (also through Dominic) to establish a system of disease surveillance based on participation of community village workers. We trained young villagers in research ethics and basic diagnostic skills to establish a database that is becoming a primary source for future population studies in these interesting populations. Through the years we always felt that it was important not to disappoint those great scientists who placed a lot of confidence in us to promote science and

build capacities in our developing country and to persevere against all difficulties and odds.

COLLABORATION IN MYCETOMA RESEARCH BETWEEN SUDAN AND BRITAIN

Mycetoma is a chronic granulomatous, progressive, disabling and destructive inflammatory disease. It usually involves the subcutaneous tissue most probably after traumatic inoculation of the causative organism. Mycetoma may be caused by true fungi or by higher bacteria. The triad of painless subcutaneous mass, multiple sinuses and sero-purulent discharge containing grains are the cardinal features of mycetoma. Mycetoma has a world-wide distribution. It is endemic in many tropical and subtropical countries that include Sudan, Somalia, Senegal, India, Yemen, Mexico, Venezuela, Columbia, Argentina and others. In these areas it affects the poor and is one of the neglected diseases. The causative organisms in Sudan include *Madurella mycetomatis*, *Streptomyces somalienses*, *Actinomadura madurae* and *Actinomadura pelletieri*. *M. mycetomatis* is the most common cause of mycetoma in Sudan and is difficult to treat.

Collaboration in research between Britain and Sudan in mycetoma started in the late 1960s as collaboration between the Ministry of Overseas Development UK, WHO, Faculty of Medicine, University of Khartoum and the Sudan Ministry of Health (Murray, 1960). A well-equipped laboratory was established in the Department of Microbiology in the Faculty of Medicine. Beds were made available for the project in Khartoum North Hospital. The project addressed epidemiology, clinical manifestations, diagnosis and treatment of mycetoma. The Director and initiator of the project was Professor EL Sheikh Mahgoub, Professor of Microbiology, Faculty of Medicine, University of Khartoum, assisted at the time by Dr Samya Ahmed Gumma, who later became a professor in the department.

In 1991 a Mycetoma Research Center was established by Professor Ahmed Hassan Fahal at Soba University Hospital of the University of Khartoum. Professor Fahal, known for his meticulous attention to detail, established wards and a laboratory in the centre. The research included epidemiology, new diagnostic procedures and treatment modalities. New strains of *S somalienses* were discovered. This was in collaboration with Professor M Goodfellow of the University of Newcastle. Nine strains isolated from mycetoma patients and labelled as *Streptomyces somaliensis*

were the subject of a polyphasic taxonomic study. The organisms shared chemical markers consistent with their classification in the genus *Streptomyces* and formed two distinct monophyletic subclades in the *Streptomyces* 16S rRNA gene tree. A draft genome sequence of the human pathogen *Streptomyces somalienses*, a significant cause of actinomycetoma, was recently published by the same group.

COLLABORATION WITH THE NETHERLANDS IN MYCETOMA

The collaboration between the Mycetoma Research Center and the Netherlands was initiated by Professor Fahal and Dr E.E. Zijlstra, who was then a visiting lecturer at the IEND. He was supported by Professor H. Verbrugh and Professor van Belkum of the Department of Medical Microbiology and Infectious Diseases, Erasmus Medical Centre, Rotterdam University, The Netherlands. Several projects that addressed various aspects of mycetoma were initiated. Dr A.O. Ahmed from Khartoum and Dr van de Sandy from Rotterdam obtained their PhDs from Rotterdam University. They are now leading scientists in molecular diagnosis and genetics of eumycetoma. A third student is currently doing her PhD. The collaboration had enabled several young scientists to be trained in Rotterdam and to transfer some modern technology to Sudan. Twenty-four high quality articles were published in high impact journals. The North–Sudan collaboration enabled the Mycetoma Research Center to be one of a kind worldwide in patient management and mycetoma diagnosis.”

COLLABORATION BETWEEN SUDAN AND THE UNITED STATES IN HEALTH RESEARCH

There was some collaboration between Sudanese and American scientists in health research. An important project was started in the 1980s between Michigan University and the National Public Health Laboratory in Sudan. The project covered onchocerciasis which is also known as river blindness (Richards *et al.*, 2001). It is a parasitic disease caused by infection by *Onchocerca volvulus*, a nematode. Onchocerciasis is second in the world only to trachoma as an infectious cause of blindness. The parasite is transmitted to humans through the bite of a black fly of the genus *Simulium*.

Several Sudanese scientists were involved in the project: Hashim Warsama Ghalib, Mamoun Humaida, EL Hady Ahmed EL Sheikh,

Suaad Suleiman and several young scientists. The American scientists included Professor Charles Mackenzie, J.F. Williams and others. The project addressed several issues that included epidemiology, clinical manifestations, immunology, prevention and treatment. The drug ivermectin was used as an effective therapy. The Carter Center supported work to treat onchocerciasis as a mass treatment in endemic areas of Sudan, particularly South Sudan. This was coordinated by Professor Mamoun Humaida. One of the great achievements in controlling onchocerciasis took place in the Abu Hamad area in Sudan. This is what Dr Kamal Hashim, Director of the National Programme for the Prevention of Blindness at Sudan Federal Ministry of Health, had to say about the project: "Together with partners like The Carter Center, we worked with community volunteers to revitalize the control programme and transform it into a strategic river blindness elimination programme. I am proud that Sudan accepted the elimination challenge in 2006, and it gives me great joy to declare that we've succeeded in interrupting transmission of this ancient scourge in Abu Hamad."

On May 3, 2012 the Ministry hosted an official ceremony in Sudan's capital to recognize Abu Hamad's success, which was attended by decision makers and leaders, experts and partners.

SOUTH-SOUTH COLLABORATION IN RESEARCH

Drugs for Neglected Diseases Initiative (DNDi)

Although the last few decades have witnessed great advances in the development of new and effective drugs, drugs to treat some of the major diseases affecting the poor in developing countries have not witnessed the same advances and remain toxic, expensive or are no longer being produced. The situation changed in 2003 when DNDi was established.

The Drugs for Neglected Diseases Initiative (DNDi) (dndi@dndi.org) is a collaborative, patients' needs-driven, non-profit drug research and development (R&D) organization. It is developing new drugs for neglected diseases that include leishmaniasis, sleeping sickness (human African trypanosomiasis, HAT), Chagas disease, malaria, paediatric HIV and specific helminthic infections. Working with the international research community in both developed and developing countries, the pharmaceutical companies and other relevant institutions, DNDi pledged itself to deliver 11 to 13 new treatments by 2018 for these diseases and to establish a strong R&D portfolio.

To achieve its goals, DNDi established several platforms in the different endemic countries. One of these is in East Africa and addresses VL, its treatment and complications (LEAP Platform, 2013). The countries involved include Ethiopia, Kenya, Sudan and Uganda. The overall aim of the platform is to strengthen clinical research capacity. This platform also serves as a base for ongoing educational cooperation between the countries in the East African region and for standardization of procedures and practices within the region, as far as is possible within the confines of local regulations. LEAP evaluates, validates and registers new treatments that address regional needs for VL.

A lot has been achieved in the countries of LEAP. This is what Dr Ahmed Mudawi Musa of the Institute for Endemic Diseases, and LEAP Chairman, has written: "As important as the effort to find a new drug or a combination of drugs to treat VL, LEAP is addressing other critical issues associated with clinical research for neglected populations: capacity building with excellent training of African scientists and supporting staff, and concrete community participation in development and infrastructure strengthening in rural areas. With the help of LEAP and DNDi, we have facilities that allow us to serve the unprivileged and marginalized communities with medicines at the village level at the Kassab Hospital and Professor EL-Hassan Center for Tropical Diseases, Dooka" (LEAP Platform, 2013). The same has happened in other East African countries. More importantly the African scientists have started working together for the welfare of local communities. It is gratifying to see that DNDi, through its platforms, is growing in leaps and bounds.

It is quite clear that our institutions in Sudan have benefited greatly from the collaboration with colleagues and institutions in Europe. It was possible to develop infrastructure, solve some of the health problems affecting the poor and train medical cadres in research and in the provision of high quality health services at the community level. Had it not been for the sanctions the academic institutions in Sudan could have achieved more.

PROBLEMS AFTER THE SANCTIONS

Sudan is characterized by a diversity of health problems. These problems are further enhanced by the upheaval due to war, displacement, famine, refugees and the changing pattern of diseases with the emergence of diseases of affluence, particularly in major cities. All health indicators

show that endemic and communicable diseases are considered among major health problems in Sudan. All these need to be addressed through well-orchestrated health research mechanisms.

Lack of funds is a major problem. In several strategic research plans conducted over the last 30 years it was recommended that 1–3% of GNP should be allocated to research. This was never implemented. Consequently research output in Sudan is low.

When Sudan was one country before splitting into Sudan and South Sudan, there were 26 universities. A survey conducted by the Federal Ministry of Health at the time showed that all the newly established universities were poorly staffed (unpublished report. Document is available in the Federal Ministry of Health). Priority was given to teaching. There were only three institutes (10.7%) where the number of researchers exceeded 40, whereas more than 50% of them only have up to ten researchers or less. Only three of the older universities were undertaking research, but even these did not have enough funds and consequently the number of publications was still low.

There has been an improvement in research output since 2003 in some Sudanese institutions, largely as a result of working with foreign colleagues in projects supported by European Universities and NGOs. At the present time we are largely dependent on funds from NGOs. This cannot continue for ever and the Sudanese Government must set aside a budget for research. They can collaborate with friendly countries in the procurement of equipment, reagents and drugs.

The different academic societies of the Sudanese Medical Association are contributing a lot to the dissemination of research results by holding annual meetings in Khartoum. These meetings are attended by scientists from many parts of the world, including prominent Sudanese working abroad. We also participate in meetings abroad when we can.

I give just one example of a scientific society that has contributed to upgrading of services, research and training: The Sudanese Society of Gastroenterology. It was established 30 years ago. Every month, without fail, they hold a scientific meeting. The result is continuous updating of practice, training and research. Many young gastroenterologists have been trained and have established specialized GIT units in the rest of the country.

EMERGENCE OF NEW PROBLEMS AS A RESULT OF SANCTIONS

The problems
of research and
the plight of
researchers in
Sudan

Some malpractice has begun to appear. There are still many researchers abroad who want to work on the health problems of underdeveloped nations. They cannot do this in collaboration with academic institutions under sanctions in the developing countries, and therefore resort to other practices. Because of the lack of opportunities encountered by potential young researchers in developing countries as a result of sanctions, they fall easy prey to practices that serve them individually but are harmful for research development in the country. One of these practices involves young Sudanese scientists teaming up with foreign researchers or groups of researchers to research a problem in Sudan. It is irrelevant whether this is a priority for Sudan or not.

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Often the collaboration is not through local institutions. The role of the young researcher is to collect material and data for a project that was conceived, designed and largely implemented, if at all, abroad. Ethical issues are ignored and local capacity building is nil. We have coined the term “hunters and gatherers” for such practices. Worse still are cases where Sudanese scientists have trained abroad and sneak back into the country to collect samples through friends and colleagues, or directly from the community. The scientists disappear and nothing more is heard from them or their research.

While we welcome collaboration with developed countries in research, this should be strictly regulated to ensure relevance, capacity building and the adequate contribution of local researchers to the design and implementation of research.

PROBLEMS WITH PROCUREMENT OF EQUIPMENT AND REAGENTS

There is now a big problem in obtaining equipment and reagents for research and diagnostic purposes. In my own histopathology services laboratory and at the Institute of Endemic Diseases, there are important reagents that we simply cannot obtain. If we write to a firm, we frequently receive no response. Those that do reply simply state that Sudan is under sanctions. If a friend from abroad tries to help by sending us an item, the international mailing companies refuse to deliver the item. We thus have to make do with what is available to us. In some cases it is impossible to make a correct pathology diagnosis because a specific test is not available. As a consequence, the patient is denied the correct therapy and may die.

The same problem applies regarding research reagents. We often have good research material but are unable to perform certain tests that are denied us as a result of the embargo. I have manuscripts on file that cannot be published because crucial investigations are incomplete. Graduate students working with me and my colleagues have to make do with what is possible rather than carrying out best practice.

Even if we have a paper that has been accepted for publication we are not able to cover the expenses of the publication. We cannot transfer money from Sudan. My personal bank account with a bank in England has been frozen and my credit card is invalid. We therefore have to publish in local journals or in a WHO, Arab or African periodical.

In the past most of my papers were published in reputable journals free of charge. Journals used to cover expenses from annual subscriptions and advertising. Now commercial companies have entered the arena. They come to agreements with journals that enable them to communicate directly with authors, choose reviewers and charge the authors. No paper will be published without settling the charges, which may be 1000 US Dollars or more. There is no doubt that the publishing companies have helped the old journals to survive, perhaps at a price.

BRAIN DRAIN

Accurate data on the emigration of the medical cadre are not available. There is no doubt that the brain drain has been increasing over the last few years. For example, in 2000 the medical professionals who left the country numbered 960. This rose to 6590 in 2011 alone.

On 2nd December 2012, the Ministry of Labour published the following figures for emigration from Sudan:

The number of medical Doctors who left the country in the last 5 years was 5028.

During December 2012, 12 medical specialists resigned from the Faculty of Medicine, University of Khartoum and Soba Teaching Hospital of the University because they have signed contracts with hospitals or universities in the Gulf States.

What are the causes of the exodus?

We have well-trained medical professionals who are rendered impotent because they lack the facilities to practice their professions. There is nothing more frustrating than to see a patient getting worse and eventually dying because he cannot be diagnosed properly or given the right drug because we cannot import it. This frustration is one of the reasons why medical doctors leave the country. Furthermore, the career structure for researchers and medical practitioners is poor and financial rewards are ridiculously low. There are also few jobs available for those who graduate with higher degrees from Sudanese universities. We do not have figures for the rate of unemployment for health professionals, but from everyday experience we know that it is quite high. I know that the majority of those who obtained their MSc or PhD degrees from our Institute of Endemic Diseases in Molecular Biology and Immunology are jobless. These two disciplines are nowadays regarded necessary for proper research and patient care.

Those who left the country for Europe, the United States or other countries have done extremely well and have contributed to medicine and science in the name of Sudan. They never forget their homeland. They participate in all the annual scientific meetings held by different Sudanese associations. Some regularly visit the country to render services in their area of expertise.

One final problem is the absence of a national body for research policy, a body that sets priorities of research in the country, coordinates research activities and most importantly, funds research. This was the function of the National Council for Research in the 1980s, which was dissolved along with its specialized councils. According to Professor Abdullah Ahmed Abdullah in a key address titled “Basics and horizons of a strategic plan for Scientific Research in Universities”, there is a document detailing a strategy for research in universities in the Ministry of Higher Education and Scientific Research, but the ideas in the document were never implemented (Abdulla, 2013). Professor Abdulla’s paper was delivered in a conference organised by the University of Gazira, one of the major universities in Sudan, to update their research policy.

CONCLUDING REMARKS

I have tried my best not to charge this article with emotion, but must end by saying this: “For some of us who are at the end of their professional career, it is heartbreaking to see what is happening to the nation”. I

suppose we have to continue doing our best in these difficult times and where there is a will there is a way.

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