

Acceptance for the *Honoris Causa* Doctorate
at the University of Johannesburg, South Africa
by **Romain Murenzi**, Executive Director
TWAS – The World Academy of Sciences
for advancing science in the developing world

**Title: What key developments are likely to transform society
in the next decade?**

24 April 2019

Professor Angina Parekh, Acting Chancellor

Professor Tshilidzi Marwala, Vice-Chancellor of the University of
Johannesburg

Dr. Nolitha Vukuza, Acting Vice-Chancellor,

Professor Daniel Mashao, Executive Dean, Faculty of Engineering
and the Built Environment,

Prof Kinta Burger, Registrar:

Dignitaries, Guests, Friends, and, most importantly, graduates,

It is a great pleasure and honor for me to be invited today to receive an honorary doctorate from this great African University – I am delighted to humbly accept this important distinction. My family was not able to join me in this ceremony. I owe this great honor to them. Chantal (my wife), Isaro (daughter), Imena and Nganji (sons), this award is dedicated to you. Nevertheless, I am pleased

to be surrounded with several close friends and fellow members of TWAS. Thank you very much for being here.

Please allow me also to thank the Vice-Chancellor and his staff for the excellent hospitality I have received since my arrival in Johannesburg. I thank TWAS staff in Trieste for the great work we have been doing together since 2011, "**advancing scientific excellence in the developing world**" with special attention to Least Developed Countries and Africa.

Lastly, let me extend my heartfelt congratulations to the graduating class of April 24, 2019. You have worked hard. And you are deserving of this moment. Don't let it pass you by without taking time to savour what you have accomplished.

Let me also congratulate the parents, spouses, family members and friends. You too have contributed mightily to the graduates' success, and you too have every right and reason to be proud.

To the graduates, after all of your hard work, I don't need to remind you that your life's journey is just beginning.

Through all of the twists and turns that you will undoubtedly encounter, I am confident that your journey will be filled with accomplishments that will prove to be both personally rewarding and socially valuable.

South Africa – and Africa in general – are lucky to have you. Our continent has an acute shortage of scientists. It is said that Africa

will need more than one million scientists and engineers in the next decade. The skills and knowledge you have acquired in the various fields of engineering – including Mining Engineering, Chemical Engineering, and Industrial Engineering – are in critical need.

It is no exaggeration to say that the future of Africa depends on you.

Dear students

Distinguished guests,

Ladies and gentlemen,

On this great occasion, for your graduation and my honorary doctorate, please allow me to speak on a theme that is dear to me: **"The importance of science, technology and innovation for social and economic development."** I will frame this theme differently to make it more understandable. Recently, in one of the committees that I usually attend, the speakers were asked to reflect on the following question: **What key developments are likely to transform society in the next decade?**

The intuitive answer – the easy answer – might be that technology has this transformative power. Perhaps we would choose a subset of technology: Artificial intelligence. Big data. Quantum computing. Or vertical farming, or fission reactors, or...

However, I think these answers are too simple – and the question is not as easy as it seems. I would like to offer a different

perspective – less exotic, probably more difficult, but very pragmatic. And much more urgent for everyone in this room.

As already said, I work for The World Academy of Sciences – TWAS. We're based in Trieste, Italy, and we are a programme unit of UNESCO. For more than 35 years, TWAS has worked to build science capacity in the developing world – via research, education, policy and science diplomacy. Certainly a top priority for TWAS is to develop and support a new corps of PhD-level scientists in the developing world, and especially in the 47 Least Developed Countries. Our programmes have grown significantly in recent years, and today TWAS and its partner organisations offer more than 500 PhD and postdoctoral fellowships per year. We now have over 1,000 young scientists working for their PhDs. We are very proud to have reached this milestone.

So you will not be surprised if I suggest that "the key development...likely to transform society in the next decade" is the development of a new PhD-level research corps in the LDCs and other developing countries.

Earlier I mentioned that Africa will need a million scientists, engineers and social scientists in the years immediately ahead. And that could be reasonable – or the need could be much greater. Let us consider some basic numbers:

Africa has 1.2 billion people. According to the 2015 UNESCO Science Report, Africa has about 169 scientists per million people.

Botswana has an impressive science sector, and it has double that number – 344 scientists per million. If you project that number to Africa, the continent would need about 400,000 new scientists in the years ahead.

South Africa, with Egypt, is arguably the leader in African research. It has 818 scientists per million people. To match that concentration across the continent, Africa would need 1.4 million scientists.

How would this compare to Europe? Italy has nearly 2,600 scientists per million people. To match that, Africa would need 3.1 million scientists.

And Germany? 6,300 researchers per million – meaning Africa would need **7.6 million scientists** to match that concentration.

We have not even considered countries such as South Korea or Finland, where the numbers are much higher still. But you begin to see how important science is to development and to economic health – and how far Africa still must travel to meet its needs.

There's no doubt that if we could create a million new scientists for Africa in the next decade, or even two decades, that could have a very positive impact. Not only do these PhD scientists do research, but they teach and serve as mentors. They establish businesses. They provide advice to government, or enter public service. They become important links in regional and international networks.

Now, how will we assemble this corps of scientific excellence? In fact this is an **enormous** challenge. And so I must be honest: we cannot say this new science corps will be the most transformative development for the near future. That is too simple.

Rather, we must adopt a more holistic approach. There are several elements, all of them essential to a broad cultural, political and economic evolution that supports the development of this scientific capacity.

First, all levels of education that precede PhD studies. From the earliest age, we need to encourage children to explore, to think independently. *To think like innovators.* You've probably heard of "hands-on" science education, or Inquiry-Based Science Education. This is a necessary revolution in every country, South and North alike. And within this framework, we must allow children to *fail* in their research, and teach them that failure often precedes great success. Indeed, failure is almost inevitable on the way to great discovery.

Second, education and support for girls and women. To succeed in our effort, we need to identify and train every creative mind. Therefore it must be among our highest priorities to encourage girls and women to pursue their interests in science and engineering, and then support them as needed in education and in the workplace. It is a matter of arithmetic: This doubles the pool of potential scientific talent. But it also enriches that pool: Women, because of their life experiences, often will have a

different perspective, and sometimes different dimensions of creativity. This is very important for the future.

Third, Internet and communication technology. The Internet revolution combined with the mobile technology revolution is bringing education resources and tools to a growing number of people in Africa and in other science-lagging nations. Online courses and remote learning mean that education and training are accessible to more and more people, with a huge potential to transform education.

Use of this technology is growing rapidly in Africa. However, we also know that in the poorest countries, use of smart phones and access to mobile or conventional Internet connections still lags far behind use in developed countries.

Fourth, policy to support development of science capacity. Policy shapes education at every level. Policy determines public investment in research and development, and research infrastructure. It sets laws on taxes, intellectual property and business regulation, all of which have a bearing on scientific advances.

Fifth, international cooperation and the use of science diplomacy. Scientists and policymakers in the developing countries have much to learn from counterparts in the emerging and developed countries. This knowledge transfer, supported by financial aid from the more developed countries, is essential not

just for building science capacity but also for accelerating the pace of development.

In Africa, South Africa has a major role to play, as the late Nelson Mandela put it at the inauguration of ASSAf on March 22, 1998:

"The Academy should in particular also facilitate co-operation between South African scientists and other African scientists, and the sharing of our skills and technology base as a continent. This would lend strength to continental efforts towards economic co-operation and development. "

And, sixth, science academies. In many countries – especially in sub-Saharan Africa, the Middle East and Southeast Asia – academies are weak or non-existent. But the trends are positive. Our colleagues at the InterAcademy Partnership report that in 1993, there were just 9 academies in Africa. Now there are more than 20 national, regional and continent-wide academies – and another four or five have been established and are getting organised.

Academies should be seen as essential institutions. By bringing together the leading scientists of a country or region, academies create an expert and credible voice to provide policy advice. This expertise can influence education, R&D investment, law and other key issues.

Dear Students,

Distinguished guests

Ladies and gentlemen,

I have put these in numerical order, one through six. But can we say one is more important than the other? No – **all are important**. All of these resources and institutions must be strong and resilient in order to lift the world's least developed nations out of poverty and dependence.

And so I come to the conclusion:

What could be the most transformative development in the next decade and beyond? The recognition among all stakeholders that developing nations need to develop **a healthy innovation ecosystem**.

Education, the inclusion of women, changes in policy, the establishment of academies, the development of technology and international cooperation must work in concert to build a robust new generation of problem-solving PhD scientists. If we can do this, even the poorest nation can begin to emerge as China, India, Brazil, South Africa and others have emerged in recent years.

But failure to develop the innovation ecosystem also could be transformative – in a completely negative way. Failure to build this capacity, this *strength*, means that these nations will endure devastating instability – poverty and a lack of opportunity for young people, poor health, civil strife and war, mass migration and other consequences. And, as we know, the repercussions can reach into every country, poor or rich.

Professor Abdus Salam was also a firm believer that “**developing nations need to help themselves and invest in their own scientists to boost development and reduce the gap between the North and the South.**”

President Paul Kagame of Rwanda in his address to the United Kingdom (UK) Royal Society was even stronger:

"We in Africa must either begin to build up our scientific and technological training capabilities or remain an impoverished appendage to the global economy."

Finally, the late President of Tanzania, Mwalimu Julius Nyerere. He visited the Abdus Salam International Centre for Theoretical Physics in Trieste in the summer of 1998. On the second day of his stay, he had an interview with the Italian journalist Fabio Pagan, in the local newspaper, *Il Piccolo* of Trieste, on 10 June 1989.

The journalist posed a question: In your opinion, is there a future for science in Africa?

Answer: **Well, if there is no future for science in Africa, there cannot be a future for Africa in the 21st century!**

Question: So there must be a future.

Answer: **We have no place in the 21st century without a major development in science and technology.**

Dear Students,
Distinguished guest,

Ladies and Gentlemen

I thank you so much for listening. Happy Easter to you, your families and your friends. I wish all of you the greatest success on the road ahead.