Rwandan President Paul Kagame challenged Africa's science and technology community to come together to build an innovation ecosystem.

PHOTO: OFFICE OF THE PRESIDENT, RWANDA

Africa cultivates innovation to boost global reach

The Next Einstein Forum's Global Gathering 2018 explores opportunities, identifies challenges

By **Anne Q. Hoy**

Tolullah Oni, a public health physician, researcher and epidemiologist, recently traced her life journey—birthplace in Lagos, Nigeria; education in London; and professional career in South Africa—to underscore the power of inspiration, the value of education, and the importance of mentors to the vitality of Africa's scientific community, particularly for women and the continent's growing demographic of young people.

The story of Kenyan research scientist Rose Mutiso strikes similar notes. Educated at Ivy League institutions in the United States, she returned to the continent with a Ph.D. in materials science and engineering and two undergraduate degrees in engineering in hand. Wasting no time to begin to fulfill her longtime ambition to improve the lives of Africans, Mutiso cofounded and now heads the Mawazo Institute, a Nairobi-based nonprofit research institute that supports African female Ph.D. candidates whose research is focused on reversing the continent's development challenges.

Oni and Mutiso were among more than 1,600 participants from 91 countries in Africa and beyond who convened last month in Kigali, Rwanda, at the Next Einstein Forum Global Gathering 2018, where African scientists highlighted their research and participants explored how to accelerate the continent's science, technology, and innovation capacity; expand precision health care; respond to climate impacts on energy, agriculture, and economic growth; and accelerate the adoption of digital technologies to connect more African countries with each other and the rest of the world. The Forum featured a Nobel laureate, two African presidents, and representatives of the American Association for the Advancement of Science and other leading scientific societies, industries, governments, and private philanthropic organizations from across the globe.

Oni was selected as a fellow of the Next Einstein Forum, a competitive fellowship that provides recipients with global opportunities to advance their careers. She also is cochair of the Global Young Academy, an international organization dedicated to cultivating the next generation of researchers on the continent and those living abroad, and a fellow of a World Economic Forum council on the future of health and health care. She has participated in AAAS training sessions and events sponsored by its Center for Science Diplomacy.

Last year, Mutiso was named the Next Einstein Forum's Kenyan ambassador, an initiative that selects a network of working scientists under the age of 42 to represent each of Africa's 54 nations and participate in a range of public engagement activities to share news about the continent's science, technology, and innovation advances. She also is a senior fellow of the Energy for Growth Hub Initiative, for which she conducts independent research on energy sector topics. Earlier in her career, after completing graduate studies in the United States, she served as a AAAS Science & Technology Policy fellow, a position that placed her in a U.S. Senate office and at the Energy Department, where she delved into issues such as renewable energy and energy access in sub-Saharan Africa and Asia, seeing firsthand the nexus between science and public policy.

The life trajectories of Oni and Mutiso open a window into the advances taking place in Africa as the continent becomes "a generator of knowledge, innovation, creativity, and technology, rather than being solely an adapter of trends produced elsewhere in the world," as described in a white paper prepared by the African Academy of Sciences' Sustainable Development Goals Center for Africa and Carnegie Mellon University Africa. Their stories and experiences also point to continuing obstacles.

As gifted and ambitious African scholars, they followed their curiosity and absorbed the world around them from an early age. Educated abroad at top-shelf institutions, they were exposed to inspiring teachers and professors and found access to advanced laboratories and time to discover their passion. They participated

in scientific conferences with powerful networking opportunities. "This is all part of the international research community, and if you are not in it, you are out," said Mutiso.

Africa faces the world's largest shortage of primary and secondary school teachers at the very time the population of school-age students is on track to grow at the world's largest pace. In addition, 32.3% of sub-Saharan Africa's children, adolescents, and youth do not attend school, the world's lowest educational participation rate, according to the UNESCO Institute for Statistics.

Despite the work many African nations have devoted to elevating the continent's global standing in science and technology, significant challenges remain. Recent World Bank statistics show the continent contributes 1.3% to the world's total scientific research output and its research and development investments rank among the world's lowest. Scientific laboratories at African universities also are often ill-equipped, Next Einstein Forum participants said.

Creating an environment in Africa for science, engineering, and innovation to flourish begins with an educational system that is focused on science, technology, engineering, and mathematics from the elementary level through college and graduate school, a necessity repeatedly cited by multiple Forum participants.

"For too long Africa has allowed itself to be left behind, but that is starting to change as we see with the important work on display at this forum," Rwandan President Paul Kagame said in a keynote address on the Forum's opening day.

"We need to start with the basics," added Albert G. Zeufack, the World Bank's chief of economics for Africa, during a Forum session. "The learning crisis must be addressed if we are to generate the next Einstein in Africa."

Oni said Africa's young scientists need interdisciplinary and collaborative efforts to thrive.

African countries are forging agreements with other African nations to develop homegrown science and technology solutions that address specific African problems, an approach that several philanthropic groups, foundations, scientific societies, and international organizations across the world are supporting. Africa's leading scientific countries participating in the Forum each pledged to increase their national research and development budgets 1% by 2020 and 3% by 2025, according to a draft 2018 Kigali Declaration reached at the Forum—levels higher than those agreed to by participants 2 years ago.

The drive to transform the continent's scientific profile also has seen the emergence of African-run scientific research institutions, from the African Academy of Sciences' Alliance for Accelerating Excellence in Science in Africa to the African Institute for Mathematical Sciences, which established the Next Einstein Forum in partnership with the German-based Robert Bosch Stiftung (Foundation) in 2013.

Africa's growing consumer base is being met by more than 314 active technology hubs in 93 cities and 42 African countries, spurring innovations in every sector from education and health to agriculture and energy, according to the white paper.

Kagame also singled out gender disparities among Africa's scientific community as a problem that must be addressed. "As Africa catches up to the rest of the world, we cannot afford to leave our women and girls out of the equation," he said.

Attracting and preparing women and the continent's growing population of young people for careers in science, technology, and innovation was a goal repeatedly cited at the Forum. Outreach to women and the continent's youth demographic is essential to fostering the "knowledge acquisition" necessary to propel innovation in Africa, participants said.

New avenues for African women and young scientists need to be paved to expand Africa's scientific reach, said Oni during a presentation focused on bridging the gender gap in Africa's science and technology. "We need to fix the system. We need to think about the conditions in the pipeline itself. We need to do more than just plug the holes," she said. "We should be invested, more invested in new kinds of partnerships that are really finding and nurturing these hidden talents that are often stifled."

One such avenue unveiled at the Forum was the launch of a peer-reviewed, multidisciplinary, open-access journal dedicated to research by African scientists. *Scientific African*, a quarterly journal to be published by Elsevier, will focus on relevant African topics and seek to expand opportunities to showcase African research. It is slated to begin publishing later this year.

A closing day session that featured a panel of global scientific leaders, including Rush Holt, chief executive officer and executive publisher of the *Science* family of journals, examined the state of science and challenges confronting the scientific community across the world, a discussion that identified situations that the African research community may want to avoid.

The impact of the world's rise in nationalist movements along with a sometimes-negligent attitude toward evidence pose risks for the scientific enterprise and stir public distrust in science, said panel participants.

These political and social developments increase the need for nongovernmental scientific organizations such as AAAS to continue to engage and inform the public about evidence-based realities and demonstrate the many ways the scientific enterprise improves lives and contributes to global well-being, Holt said.

He pointed, for instance, to some of AAAS's many programs—science communication workshops, media fellowships that place graduate students in news outlets, and international journalism awards to highlight leading science writing—designed to implement AAAS's mission to "advance science for the benefit of all people."

As publisher of the *Science* family of journals, Holt said, AAAS makes scientific papers available at reduced rates to scientists in low- and-middle income nations and makes it possible for those who have papers published in the *Science* journals to post their manuscripts on PubMed or place them on their own repositories, in recognition of their need to share and cite scientific research.

Turning to the Next Einstein Forum's objective to help Africa build institutions and opportunities to produce the next Albert Einstein, Holt said preserving public trust in science and the freedom of scientists to pursue their ideas are paramount to global progress.

"Political, academic, and scientific freedom are not separable," Holt said. "For science to thrive, young scientists must find confidence, freedom, and sustained support. You have to have organizations that are monitoring the situation, continuing to speak out and advocating for them."

"Those who want them to succeed have to insist that science is not a luxury for nations in Africa or elsewhere."

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