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African Diaspora Scientists as Development Catalysts

Rafiou Agoro

Among the major challenges facing humanity is the need to develop effective responses to threats like climate change, demographic growth, and emerging infectious diseases. A successful response to these global threats will depend on our ability to fuse science, technology, and innovation with the practice of governance and diplomacy.

According to the United Nations, by the end of the twenty-first century Africa will host 40 percent of the global population, a remarkable rise from 9 percent in the 1950s.[1] This major growth, which undoubtedly will come with benefits and difficulties alike, reflects advances in medical science that have reduced child mortality and allowed for longer life spans, in combination with high fertility rates in many African countries. The 2014 Ebola outbreak in West Africa, meanwhile, exemplifies some of the health crises still facing the continent. A World Bank report from 2016, moreover, suggests that much extreme poverty will continue to be concentrated in Africa.[2] And according to the 2016 annual report from the African

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Development Bank, 600 million people on the continent live without access to electricity.[3] Addressing these complex challenges will require coordinated political action and commitment, as well as enlisting Africans themselves to shape the future of their continent.

A key means of transforming Africa for the future is science and technology knowledge, as applied, for example, to management of natural resources like forests, rivers, and lakes; climate change threats; and health quandaries. The further development of S&T in Africa would help in managing global threats as well. Indeed, the fear a few years ago that Ebola could spread transnationally showed how dire the need was for improved medical knowledge and education in Africa. More expertise could have helped limit the enormous damage caused on the continent by the virus. The tragedy also highlighted the vulnerability of the global population to both viral and bacterial transmission across borders.

On a continent like ours, made up of small, fragile, and young countries, establishing a unified response to crises as well as a shared optimistic vision for the future is a common-sense approach. Thus, in 2013, African governments banded together to create the African Union (AU) Agenda 2063, a significant diplomatic effort to define a common long-term goals.[4] Overall, the agenda aspired to promote a "prosperous continent, with the means and resources to drive its own development partially through science, technology and innovation."[5] Of course, achieving this overarching goal will require qualified scientists on the continent, coupled with strong international partnerships. Currently, however, S&T investment in African countries is lower virtually than anywhere else, which partially explains why these countries produce only 2 percent of the world's scientific publications.[6] The lack of investment compels many science students from Africa to pursue their scientific careers abroad, mainly in Europe and North America, with the resultant brain drain perpetuating a vicious cycle that hinders further S&T development. This is why we need to provide the infrastructure and incentives for promising scientists to remain in Africa.

Alongside outlining the status of R&D in Africa, and plans articulated through the AU Agenda 2063, this paper emphasizes the potential of African diaspora scientists to advance S&T development on the continent; it correspondingly suggests the creation of an African diaspora scientists federation and discusses what it could accomplish.[7]

Research and Development in Africa

R&D intensity varies widely by country on the African continent, as detailed in figure 1. Overall, in 2013, despite having 15.4 percent of the world's population,[8] the continent accounted for just 1.3 percent of global R&D expenditure, while the Americas, Asia, Europe, and Oceania accounted for 32.4, 42.2, 22.7, and 1.4 percent, respectively.[6] Most African countries, further, spend less than 1 percent of

their gross domestic product on R&D.6 This meager public investment is hardly adequate to drive technological development and economic growth, especially when paired with the world's lowest private-sector investment in R&D.[6]

In addition, economic diversification and R&D in Africa are hampered by a chronic skills shortage. In 2013, the United Nations Educational, Scientific and Cultural Organization (UNESCO) reported proportions of 91 researchers per million inhabitants in sub-Saharan Africa and 495 per million in North Africa. The highest sub-Saharan score goes to South Africa (818 per million), while the lowest is in Lesotho, the tiny nation landlocked within South Africa (21 per million), as shown in figure 1. Although these statistics have improved since data were collected in 2007, they still fall well below the world average of 1,083, indicated also in figure 1. The low share of international scientific publications (2.6%) and a slim 0.1 percent of U.S. Patent and Trademark Office patents in 2014 follow from these statistics.[6]

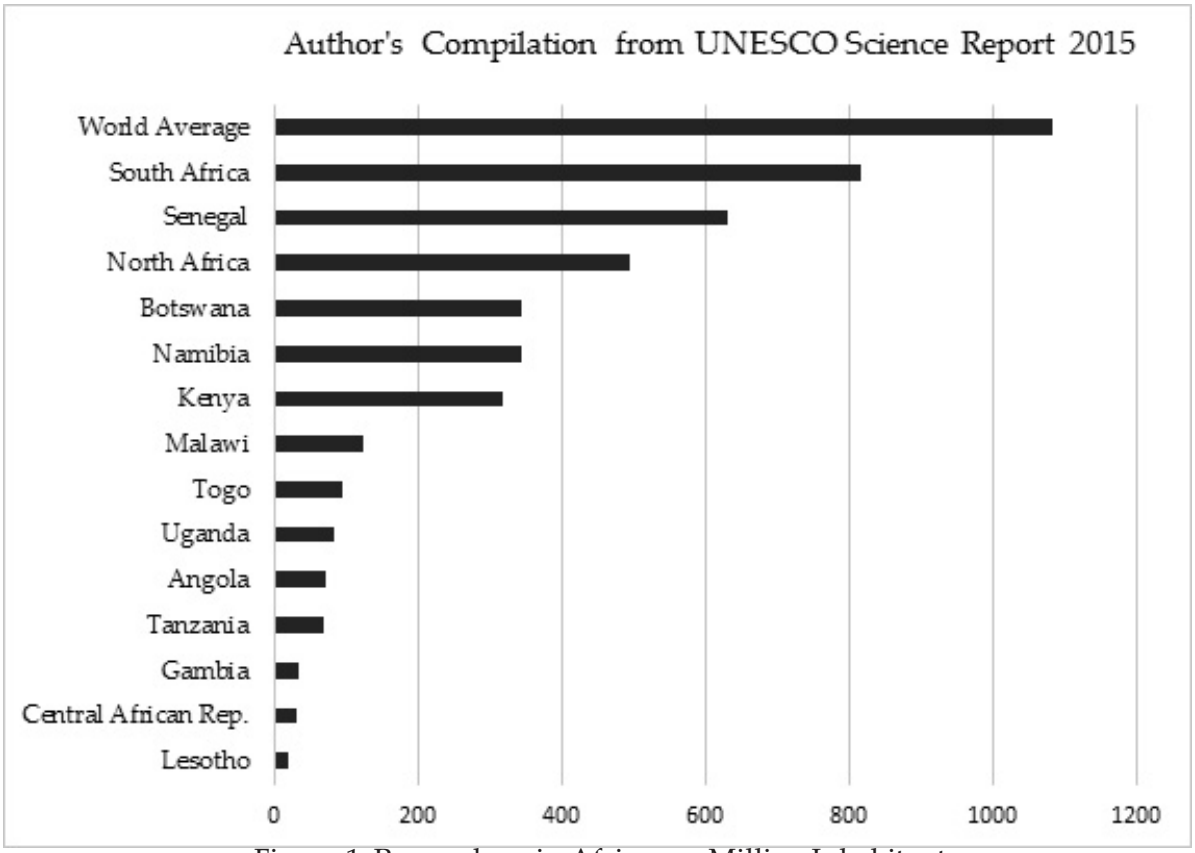


Figure 1: Researchers in Africa per Million Inhabitants

The unimpressive numbers, though, belie important recent S&T developments in Africa. At the national, regional, continental, and international levels, leaders clearly acknowledge the importance of science, technology, and innovation (STI) for sustainable development and inclusive growth under improved African governance. Since 2009, several countries have substantially increased their financial commitment to R&D. For example, Ethiopia, Kenya, and Mali have

boosted their R&D budgets by more than 200 percent to reach 0.61, 0.79, and 0.66 percent of their GDP, respectively.[6] Furthermore, many African governments are increasingly acknowledging the need to incubate companies that engage in innovation and to encourage R&D institutions to bring their projects to commercial scale, thus advancing technology and economic growth.

STI in Africa's Policy Plans

The AU Agenda 2063, introduced earlier, is a substantial effort based on national, regional, and continental best practices for socioeconomic development. It is aimed at accelerating the implementation of past and current continental initiatives for growth and sustainable development. Among these initiatives are the Lagos Plan of Action (LPA; 1980–2000), the Abuja Treaty (signed 1991), the New Partnership for Africa's Development (NEPAD; adopted 2001), the Comprehensive Africa Agriculture Development Programme (CAADP; 2003), the Minimum Integration Programme (MIP; adopted 2009), and the Programme for Infrastructure Development in Africa (PIDA; signed 2010).[9] The guiding vision behind Agenda 2063 dovetails with the AU's aspiration to create "an integrated, prosperous and peaceful Africa, driven by its own citizens and representing a dynamic force in international arena."[4]

The AU's fifty-year plan calls for Africa to transform itself from dependence on natural resources to durable economies driven by manufacturing, effective participation in the global value chain, and S&T leadership. In particular, the agenda calls for expertise in areas such as biotechnology, genetic engineering, space exploration, and deep-sea mining. A critical mass of trained engineers, doctors, and technicians in a wide range of skill areas will be required to build Africa's infrastructure, factories, health centers, and hospitals, and to power the continent's overall development.

A current national model for African S&T transformation can be found in Rwanda. Indeed, just a little more than two decades after the country endured a genocide, it ranked third on the continent in science capacity, making it an exemplar for the world's least-developed countries.[10] As Rwandan president Paul Kagame put it in 2016, at the 27th General Meeting of TWAS, "In the developing world in particular, science plays a critical role in our socio-economic transformation by helping to narrow the gap between us and the more developed regions."[11] Making Rwanda's ascent all the more remarkable is its relative lack of natural resources. Having been one of the continent's poorest countries in 1990, Rwanda later in the decade drafted a policy document, Vision 2020, aimed at fortifying its S&T profile.[12] Rwanda has since made the necessary investments in education, and established the international partnerships, to meet national development needs and thrive in S&T.[13] For instance, from 2011 to 2015, Daniel Rukzambuga, a professor at the National University of Rwanda who develops national strategies to protect

coffee beans against pests, partnered with Thomas Miller, an entomologist at the University of California, Riverside, Sue Jackels, a chemist at Seattle University, and others to produce a collaborative innovation strategy for preventing "potato taste defect," a mysterious potato odor that emerges in coffee beans when infested by antestiopsis, commonly known as the coffee bug.[14] Currently, the Global Knowledge Initiative, a Washington, D.C.–based development agency, is joining with Rwanda's National Commission of Science and Technology to help develop and vet robust, well-planned STI investment strategies to drive sustained economic development.[15] In light of these promising initiatives, overall economic growth in Rwanda today stands at 8 percent, with university enrollment near 80,000, compared to 3,000 before the genocide.[13] The Rwanda case thus shows that the poorest nations can build their future based on science through local initiatives and strong international partnerships.

On a continental scale, S&T is being boosted by the African Science, Technology, and Innovation Policy Initiative, a program established by UNESCO in 2007. [16] This initiative is aimed at supporting teachers and policymakers through a series of subregional and national S&T training courses and workshops, as well as through helping develop national STI policies in African countries.[17,18]

Tapping the Potential of the African Diaspora

The diaspora is referred to by the AU as the "sixth region" of Africa, consisting of peoples of African origin living outside the continent, irrespective of their citizenship and nationality, who are willing to contribute to the development of the continent.[19]

Indeed, despite having acquired citizenship elsewhere, many diaspora Africans maintain close ties, often family ties, and intimate interest in their countries of origin. This tight connection is demonstrated financially in remittances, which amounted to more than USD 60 billion in 2016 alone, according to the International Fund for Agricultural Development.[20] Remittance payments can help fuel economic development by increasing the purchasing power of recipient households, although the money most often goes toward needs such as food, healthcare, and educational expenses. The World Bank Household Survey 2009, conducted in Burkina Faso, Nigeria, Senegal, Kenya, and Uganda, confirmed that food, health, education, and new home construction are among the most common uses for diaspora remittances. Notably, in the countries surveyed, households receiving international remittances have substantially higher ratios of members who have completed secondary and postsecondary education.[21] The remittance payments, of course, have their limits and will not be sufficient over the long term to sustain the job needs of this growing and educated population. Thus, new diaspora-focused strategies should be devised to more efficiently support the continent economically. One related project could involve diaspora seeding of high-production local businesses such as

raw-materials-processing and pharmaceuticals factories, which in turn could help stem talent outmigration.

Along these lines, "African brainpower" in the diaspora can be said to consist of professionals such as scientists (medical doctors, researchers, and academics), lawyers, and businesspeople. These professionals could work together with African governments and civil-society groups to boost development and accelerate progress toward ending extreme chronic poverty. African diaspora scientists, especially, while still maintaining their work abroad, could assess how their S&T expertise might most effectively spur African development. In doing so, they can work closely with Africa-based entrepreneurs as well as international philanthropists to find the best tools for continental development.

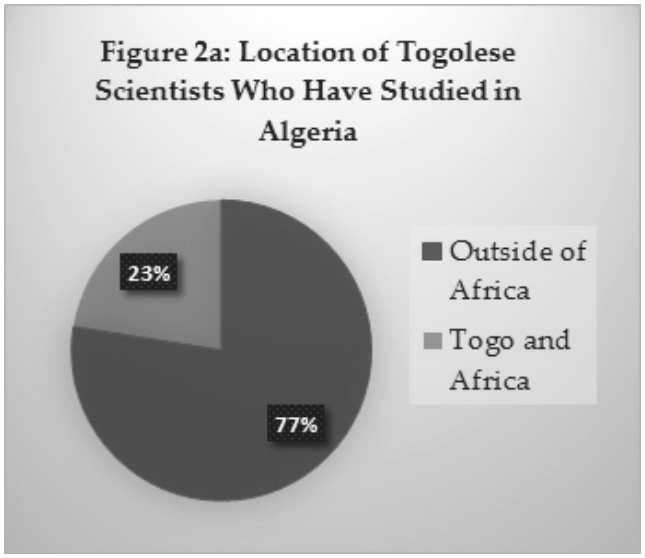
A Case Study of Togolese Diaspora Scientists

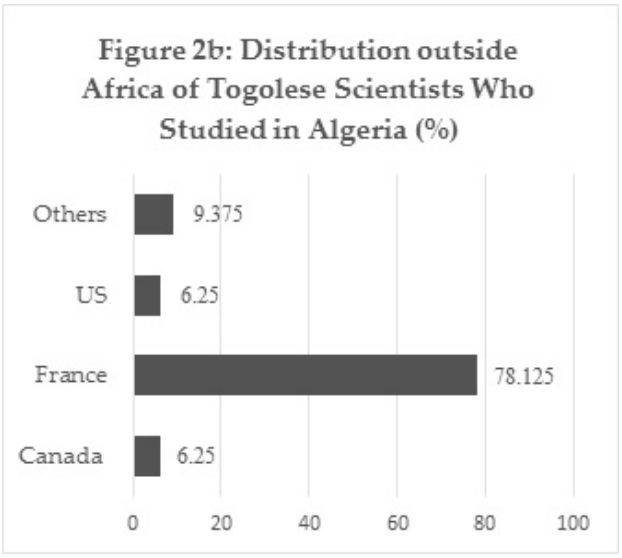
In 2001, the Sudanese mathematician Mohamed H. A. Hassan, who has served as president of the African Academy of Sciences and executive director of TWAS, cited in a *Science* editorial an estimate that 30,000 PhD holders of African descent, mainly in the sciences, live and work outside the continent.[22] These numbers, Hassan noted in the same piece, far exceed the number of African-born PhD scientists still on the continent.[22] The trend whereby scientists flee Africa has persisted. A 2013 report by the UNESCO Institute for Statistics reported that sub-Saharan Africa ranks second in doctoral-student outward mobility (4%), behind Central Asia (7.6%).[6]

While more recent data are required to ascertain the exact numbers of African scientists abroad, a case study of Togolese scientists in the diaspora, of which I am one, provides insights about the current brain drain. Through international cooperation fellowships, the Togolese government selects highly deserving high school graduates each year and sends them to Algeria for university studies.[23] The fellowship covers a five-year training program necessary to earn an engineering or master's degree, mainly in the sciences. After the training program (or even before), most students continue their university training by moving to countries with highly developed science infrastructures, such as France, Canada, or the United States, for a complementary PhD program. Upon earning their degrees, the students receive access to diverse opportunities in their host countries, in either the private sector or research community. Such prospects can be highly attractive given the lack of comparable options at home in Togo. An altogether commendable initiative, aimed at enhancing science knowledge, thus perpetuates the departure of scientific talent from the continent.

Looking more closely at this case, I have analyzed the academic and professional trajectories of fifty Togolese students from 2005 to 2011. These students, selected based on merit, were enrolled in Algerian universities through the Togo-government-run fellowship program noted before. As illustrated in figure 2(a),

nearly 80 percent of students over this period began their careers abroad. These professionals, in countries with significant existing S&T expertise, represent an abundant source of potential value to Togo (see figure 2b). Although they do send money and goods home to their families, their impact on Togolese STI remains suboptimal or null. Moreover, Togo assumes additional costs through the fellowship program, such as by covering students' expenses during their training in Algeria. The Togo-to-Algeria dynamics apply as well to students sent to Morocco, Tunisia, France, Canada, Russia, and other countries. And the outflow of science knowledge, as this paper has made clear, is hardly unique to Togo; it applies all over the continent. Recapturing some of this diaspora brainpower, if not the residents themselves, could be a major missing piece to the S&T puzzle in Africa.





At the level of specific fields, the analysis shows that these Togolese scientists end up in engineering, computer sciences, biological sciences, mathematics, and physics, as shown in figure 2(c). These are precisely the skills Togo and other African countries need to spur wealth through knowledge and to build a government-supported STI-based economy, as countries like South Korea have done.[24] This STI economy, complemented by wealth generated from human capital and effective management of natural resources, can help forge a prosperous Africa.

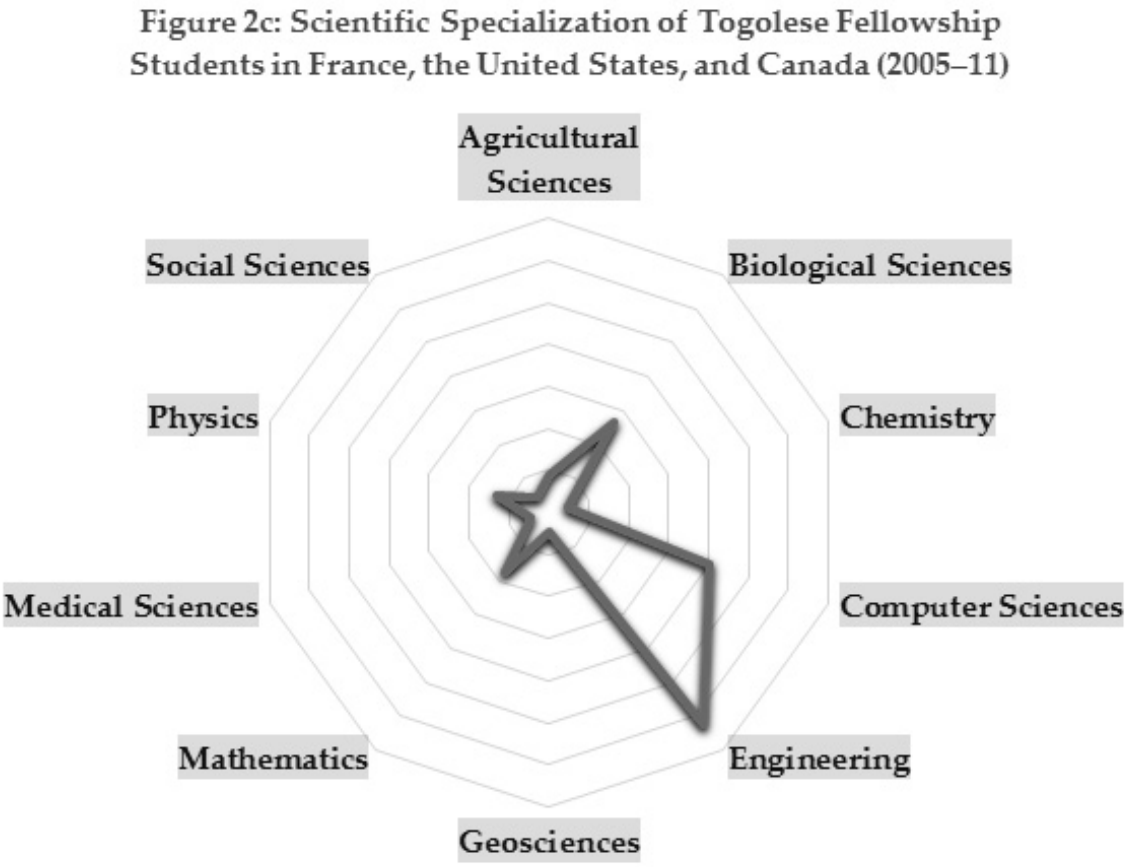


Figure 2: Togolese Students in Algeria

Source: Author interviews regarding the Association des Etudiants et Stagiaires Togolais en Algérie (AESTA; Association of Togolese Students in Algeria); see the AESTA Facebook page: https://www.facebook.com/aestatogo/.

Building Bridges

One way diaspora scientists could help promote trade and economic development for African countries is by building bridges between countries both on and off the continent. Beyond existing regional efforts at diplomatic integration, African nations must become more involved in stimulating transnational, transregional, and continental integration.[25] Total continental integration, characterized by the free movement of goods and people, should likewise boost S&T activities. The African integration could have several impacts on S&T improvement in Africa as:

- Greater mobility of scientists, engineers, and businesspeople
- Promotion of interuniversity collaborations and establishment of shared transnational R&D infrastructure
- Stimulation of public-private partnerships across national and regional borders
- Adoption of regional intellectual-property-rights-protection frameworks
- Setting up of transnational innovative firms
- Creation of financial instruments for innovation

- Improvement of the climate for regional innovation activities
- Harmonization of technical standards and research regulations

Moreover, the barriers for African economic development remain multifactorial. Embracing S&T will be pivotal in allowing the continent to reach its full potential. Here, we can introduce the notion of "diaspora science diplomacy," which would grant African diaspora scientists the responsibility to both advance continental development through S&T and advocate for African S&T in the world as a means of improving life in Africa. An entity that might emerge from this sort of deliberation is the earlier-mentioned African diaspora scientists federation (ADSF), which could include the following elements:

1. An African diaspora scientists Rolodex based on a strong professional network, along with a meeting and conference infrastructure and an active promotional wing
2. Clear classification of diaspora scientists by field
3. A series of projects rooted in intra- and interdisciplinary collaboration

As a basis for its work, the ADSF should use science and diplomacy tools, relying on collaboration to reach its objectives. This scientific cooperation by African diaspora scientists might improve intra-African relations and integration toward ensuring safety and security, thus favoring the stability necessary for African development. In this endeavor, the ADSF could offer counsel at various governmental and societal levels in the context of a globalized world. Particular tasks could include analysis of and suggested improvements to contracts between multinational companies and governments, with the broader goal of helping improve local S&T ecosystems.[26] The ADSF, moreover, could serve an intermediary role in creating efficient private-public partnerships involving multinational and nationally based corporations. It could also empower these public-private partnerships to accelerate technology transfer, which remains difficult to achieve in Africa, while generating profits that can be reinvested in local businesses, thereby boosting job creating and national economies. On national STI infrastructure, the ADSF could offer short-term solutions to implement effective measures, while also providing intellectual support for medium- or long-term STI policies.

Besides operating alongside national governments, the ADSF could advise and lobby at the regional level e.g., through the Economic Community of West African States (ECOWAS), Economic Community of Central African States (ECCAS), East African Community (EAC), Southern African Development Community (SADC), Arab Maghreb Union (AMU), and at the level of the AU Commission. This process could stimulate diplomacy for science while promoting S&T advancement.

African development also requires the transformation of society through promoting a culture of excellence, and the valorization of STEM talent. Part of this transformation must include better support and recognition of the potential

discoveries necessary to expand African national and regional economies as well as the continental economy at large. Here, the ADSF could set up different mechanisms to discover, promote, and nurture science pioneers, assessing and protecting their discoveries. The ADSF could also establish S&T outreach programs in the form of consultation centers and incubators. In rural communities, the federation could increase S&T awareness by demonstrating concrete examples of innovation, such as setting up solar farms, which can improve daily life through renewable electricity generation.

ADSF members might also promote international partnerships and scientific collaborations that include African researchers or institutions, thus supporting overseas-training programs through new models that encourage "brain retention" in Africa. As an advocate of STI, the ADSF could seek funding via collaborative grant writing to impel efficient development projects. A discrete initiative could center on improving the resources of existing laboratories and developing clinical laboratory-training programs for competent professionals to better prepare for diseases outbreaks such as Ebola, which could occur in every region of the continent.

Conclusion

As this paper has outlined, African diaspora scientists could be pivotal agents in transforming the continent from chronic underdevelopment to creative emergence on many fronts. This paper has also argued that, according to the notion of diaspora science diplomacy, scientists actually have a social responsibility to help their countries of origin thrive. It need not be ironic that scientists who have left the continent, and often enjoy access to more robust resources, can now provide insights that persuade future scientists to stay. An African diaspora scientists federation, or ADSF, could be a powerful tool to lobby for S&T empowerment in Africa, while using diplomacy to enlist international science in this effort. The ADSF concept could also increase scientific collaboration between and among African countries, thus promoting the continent's integration through a science-for-diplomacy mechanism. The numbers show African diaspora scientists to be a largely untapped resource. Now the continent just needs to perceive all it stands to gain, and diaspora scientists must muster all they can give, allowing all players to embark on the tough but worthwhile journey toward continental progress. SD

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