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Building Capacity in Science, Technology, and Innovation for Africa's Transformation: The Role of Governments

Contributed by the Knowledge and Learning Department

The Issue

The call to industrialize and modernize Africa has become popular in recent years, and the AU's Agenda 2063 and the Common African Position on Agenda 2030 identify science, technology, and innovation (STI) as key enablers to achieve development blueprints.[1] In response, Africa adopted a 10-year Science, Technology, and Innovation Strategy (STISA–2024). The ACBF's STI Survey (2016) confirms the importance of STI strategies and capacity development. This policy brief highlights the role of African governments in building STI capacity and the key capacity messages pertinent to STI. African governments are responsible for building STI capacity through the policies and processes that guide investment decisions in STI, innovation capacity, and STI products and services.

The Study

Africa Capacity Report 2017 (ACR 2017) focuses on understanding the capacity imperatives for STI. It helps policymakers draw conclusions critical to STI issues, and it affects policy recommendations to strengthen the policy formulation, implementation, and impact of STI. The report is based on a survey of 44 African countries profiling the dimensions of STI in Africa. It delves into initiatives, challenges, and capacity gaps for African countries, regional economic communities, the African Union, and nonstate actors to pursue STI-driven economic activities. It also puts forward policy options for institutions of higher learning, governments, the private sector, civil society, and development partners to integrate STI into Africa's growth strategies and build the required capacity in STI as key enablers for achieving Africa's development targets.

Key Emerging Issues

State of STI in Africa

Although Africa is reorienting its development policies to include STI at various levels, its STI capacity is still very low. Only 12 African countries of 141 countries surveyed were ranked among the top 100 innovation achievers in the 2015 Global Innovation Index. Only one of 31 African countries surveyed in the 2016 Network Readiness Index was among the world's top 50 network-ready countries. Africa is characterized by poor STI infrastructure, a small pool of researchers, low patronage of science and engineering programs, weak intellectual property frameworks, and low scientific output relative to the rest of the world.

Africa remains disadvantaged on overall STI efforts due to the low investments in STI capacity development. It accounts for about 5% of global gross domestic product but only 1.3% of global spending on research and development (UNESCO 2015). Indeed, about 84% of the African countries surveyed in 2016 were ranked Low or Very Low in capacity development outcomes.

STI capacity gaps in Africa

Africa Capacity Report 2017 shows that STI capacity is one of Africa's biggest challenges. A survey of 44 African countries undertaken by ACBF in 2016 to assess capacity needs in STI priority areas showed that African countries consider training as a High or Very High priority area in STI. Investment in STI development is very low in Africa. African countries are taking a short-term approach in developing STI skills, as is evident in low public spending on research and development and scientific infrastructure.

Most African countries have weak institutional capacity to develop and sustain STI, since few public institutions have adequately qualified human resources in science and engineering. African countries have weak capacity to retain the few qualified scientists and engineers, and the migration of African skilled scientists and other experts—the "brain drain"—has further depleted Africa's STI capacity. For instance, from 2007 to 2011, the number of tertiary-educated Africans who had migrated was estimated at 450,000 (UN-DESA and OECD 2013). So, Africa incurs a net loss in skilled human capital with the critical technical skills to foster Africa's sustainable development. Zimbabwe (43%), Mauritius (41%), and the Republic of the Congo (36%) recorded the highest proportions of educated persons living in OECD countries. Burundi, Algeria, Mauritania, Chad, and Guinea are the top five African countries least able to retain their top talent (WEF 2014). So, Africa's training institutions are somehow subsidizing other developed regions since it is costly to train.

Another key challenge is the lack of accurate data to enable targeting of STI policies and strategies. The lack of a robust common set of African STI indicators has constrained the continent's capacity to make evidence-based decisions on STI. Weak capacity to manage the data affects the ability to update the STI policies and strategies and to determine how much to allocate to build STI capacities and frameworks.

There is also a huge disparity between female and male participation in research; in science, technology, engineering, and mathematics (STEM) education; and in higher and tertiary education.

Key role of governments in Africa's STI capacity building

STI capacity is built around state-of-the-art equipment and other infrastructure that require huge investments that do not yield immediate returns but are preconditions for making information and communication technologies (ICTs) affordable and usable. A society-wide effort to

1 Science, technology, and innovation refer to all activities closely concerned with generating, advancing, disseminating, and applying scientific and technical knowledge in all fields of science and technology—natural sciences, engineering, medicine, and social sciences and humanities (ACR 2017).

leverage ICTs requires concerted government efforts. So, governments need to provide a clear STI policy guidance.

The government of Rwanda showed its commitment to support STI initiatives financially and systematically. For instance, Vision 2020 recognizes the role of STI in transforming its socioeconomic landscape from an agrarian economy into a knowledge-based one, and achieving socioeconomic transformation. The vision sees STI as a strong enabler in all priority sectors including education, ICTs, health, and agriculture. Indeed the government strongly supports STI activities through the Ministry of Education, Ministry of Youth and ICT, National Commission of Science and Technology, the National Development Board, and the National Industrial Research and Development Agency.

The Rwanda Innovation Endowment Fund was also founded to stimulate economic transformation through applied S&T and research in innovative market-oriented products and processes in priority economic areas. The initial phase focused on agriculture, manufacturing, and ICTs, and the second round added energy as a fourth priority. The lesson is that the government's partnership with other stakeholders such as universities can significantly contribute to socioeconomic development, especially in applied research and innovation.

The Ethiopian government designed a 70/30 education policy with 70% of tertiary education in natural and physical sciences and technology fields and 30% in the social sciences and humanities. The government also opened technical and vocational education training (TVET) institutions and two technical universities that focus on technology as part of measures to increase training in STI.

The Morocco government created a National Support Fund for Scientific Research and Technological Development and developed a new strategy of scientific research (2015–30), which focuses on educational reform and scientific research. It resulted in the implementation of many STI capacity building programs.

Recommended Policy Options for African Governments

STI capacity building rests on African governments' commitment to take up the leading role as regulators of the economy and provide the necessary support. ACR 2017 recommends several policy options for African governments to consider building capacity for science, technology, and innovation.

- Design STI policies that are gender sensitive and bridge the gender gap by promoting women's participation and leadership in STI, and encourage young women and girls to pursue science and engineering programs. This can be done by awarding scholarships, fellowships, and other programs that increase enrollment in science, technology, engineering, and mathematics.

- African governments and the AU should pursue sustainable and innovative funding alliances with bilateral and multilateral donors, governments, private foundations, and businesses. A dedicated share of all development loans and grants received from development partners should be allocated to developing STI capacity programs and sustainable technologies and innovations for commercialization. African countries should commit to honoring the 1% share of GDP on research and development, or take it even further to 3% of GDP.

- Governments should partner with local emerging firms and start-ups at the bottom of the pyramid to create financing mechanisms, such as industry funds, association-based financing, and tax incentives to mobilize resources for STI.

- African governments in partnership with the private sector, academia, nonstate actors, and civil society organizations can carry out surveys and diagnostic analysis to identify the critical STI skills essential for economic growth. This is important to align skills development with market needs as well as Agenda 2063 priorities. That would bring industry practitioners into the development of training institutions to draw on both policy and practice to enrich curricula. The diagnostic analysis of skills needs should guide the development of curricula and targeted training programs intended to redress the skills shortage in the trade, craft, and engineering fields. Emphasis should be on technical and vocational education training, including apprenticeships and on-the-job experience.

- A regional database of critical skills for Agenda 2063 in support of STI should be established to create a comprehensive pool for intra-African cooperation in using African skills. This could be coordinated by such bodies as the ACBF or the African Union Commission to ensure that African governments complement their efforts in STI.

- Africa should curtail the brain drain by developing strategies for retaining, harmonizing, and using its STI capacity through, for example, providing incentives (monetary or nonmonetary) to Africans with critical technical skills in science, technology, engineering, and mathematics. In addition, African governments should devise mechanisms to tap into the expertise of African researchers and scientists in the diaspora by encouraging them to return for a period to their home countries and contribute to the development of STI.

- African governments should step up their efforts to develop academic and scientific mobility programs across African and emerging economies. Scientific cooperation programs in Africa led by China, Brazil, and India suggest that these three countries are willing to share their scientific and technological successes with Africa. This is a great opportunity for African countries to strengthen such partnerships.

- African governments should increase investment in education in STEM. They should create incentives that shift student preference for the humanities and social sciences toward STEM—say, through 70/30 allocations, with 70 STEM students for every 30 social science and humanities students. To develop institutional capacity, they should invest heavily in high-quality universities, state-of-the-art laboratories, information, and communications technology infrastructure.

Implications

STI capacity building in Africa depends on political will and government commitments to lead the process. The capacity to reform the economic, social, and political governance is a prerequisite for ensuring that STI is integrated into Africa's development. But governments cannot do this alone. They need to collaborate with the private sector, civil society organizations, and academia, and build on mutual trust, accountability, and effective coordination.

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