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ECA POLICY BRIEF

Science, technology and innovation in Africa

I. Introduction

Science, technology and innovation are key factors behind development and constitute an opportunity for most African countries to surge ahead to become middle-income and upper-income countries. As latecomers, developing countries need not reinvent the wheel. They can use current technology to tackle their development challenges by building their capacity to identify, adapt and adopt, on mutually agreed terms, proven off-the-shelf technology developed elsewhere.

The importance of science, technology and innovation for development is recognized in the 2030 Agenda for Sustainable Development, under Sustainable Development Goal 17, to strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development.[1] Frontier technologies can aid in the implementation of the Goals by providing "opportunities for sustainable development that are better, cheaper, faster, scalable and easy to use".[2] In line with this thinking, the African Union's Agenda 2063:The Africa We Want contains calls for a skills revolution underpinned by science, technology and innovation to boost Africa's human and social capital.

1 The 2030 Agenda for Sustainable Development was adopted by the General Assembly in its resolution A/70/1.
2 See United Nations Conference on Trade and Development, Technology and Innovation Report 2018. Available at https://unctad.org/en/PublicationsLibrary/tir2018_en.pdf.

Investment in human capital, research and development and information and communications technology (ICT) infrastructure, underpinned by strong institutions, are vital for science, technology and innovation development. In several African countries, however, the infrastructure, capacities and institutions required are still evolving. Science, technology and innovation development therefore remains slow and concentrated in a few countries. The present policy brief is intended to shed light on the status of science, technology and innovation in Africa and provide policy recommendations drawing from the experiences of best practice countries on the continent.

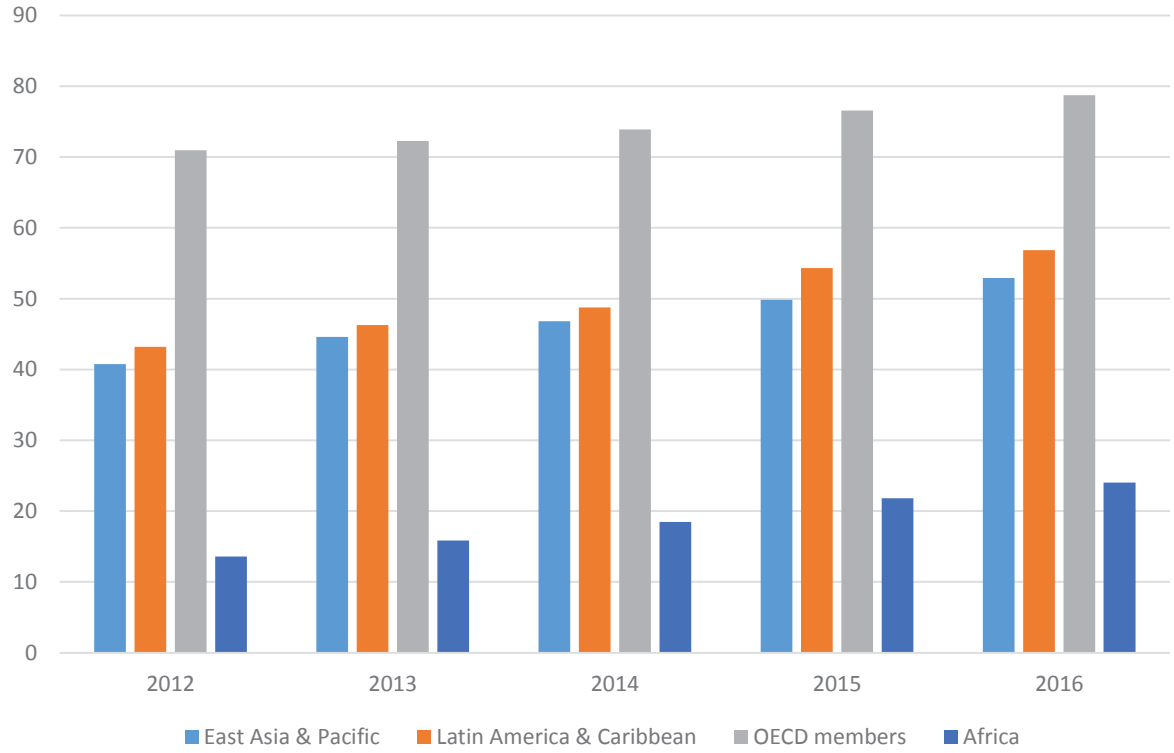
II. Pre-requisites for technological development

The factors that enable a thriving science, technology and innovation ecosystem in Africa share many commonalities with those that enable greater levels of development more broadly: having access to electricity, education and ICT and an enabling institutional and regulatory framework that inspires and rewards innovation. Without those basic building blocks, technological innovation in Africa would be stifled.

A. Science, technology and innovation infrastructure in Africa

Notwithstanding substantial improvements, having access to reliable Internet and electricity services is limited in Africa and comparatively lower than in other regions of the world. For example, the percentage of the population using the Internet in Africa increased at a rate of 15.3 per cent annually from 2012 to 2016 (see figure I). While this rate of growth is much higher than corresponding rates in East Asia and the Pacific (at 6.8 per cent annually) and Latin

Figure I: Percentage of the population using the internet by region



Abbreviation: OECD, Organization for Economic Cooperation and Development.

Note: Eritrea, Libya, and South Sudan have been excluded for reasons of data availability.

Source: Author's calculations taken from World Development Indicators Database (Washington, D.C., World Bank, last updated 5 September 2018).

America and the Caribbean (at 7.1 per cent annually), as a proportion of the population, Internet access in Africa remains far below these regions. According to Kenyan entrepreneur Erik Hersman, "You cannot have a twenty-first century economy without power and connectivity."3

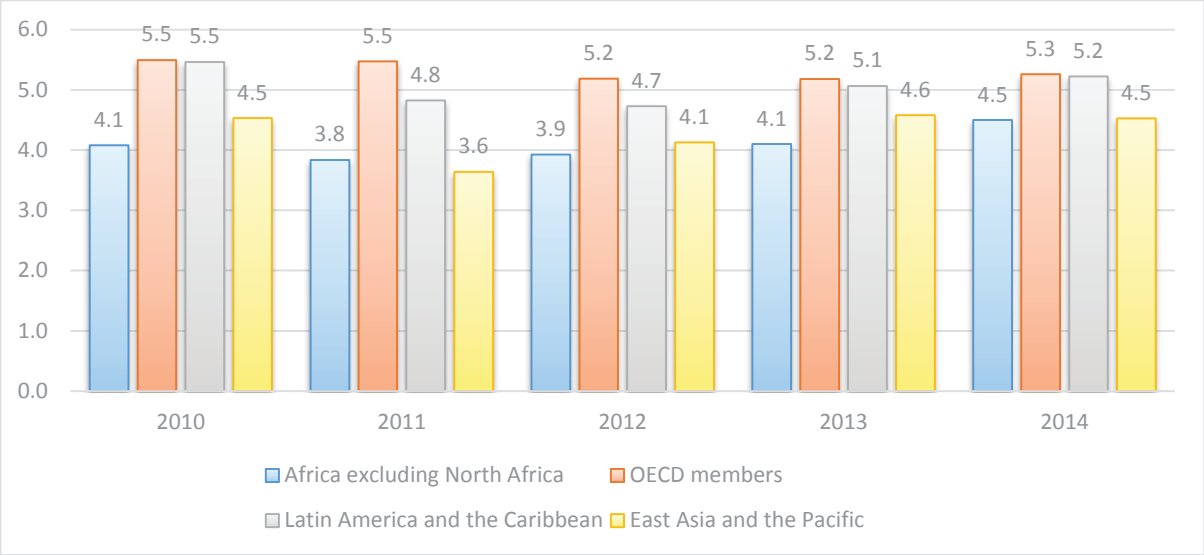
Having access to electricity (a precondition for Internet access) remains an aspiration rather than a reality for nearly half of Africa's population. In 2016, 53 per cent of Africa's population had access to electricity. Although that was a considerable improvement on the 44 per cent that had access in 2010 and the 39 per cent in 2000, access issues still inhibit progress in science, technology and innovation. The regional divide here is very stark: while 99 per cent of North Africa's population has access to electricity, in Central Africa, only 20 per cent of its population does.4 Foreign direct investment (FDI) is contributing to an expansion of energy access in Africa, specifically in alternative and renewable energy. FDI worth $12.2 billion flowed into African alternative and renewable energy projects in 2015. This is 18 per cent of all FDI, although investment in coal, oil and natural gas still outpace renewable investment.4

III. Human capital development and research and development in Africa

Science, technology and innovation development requires an educated workforce and a commitment to research and development. Even though human capital development is the basis for a sustainable research and development programme, investment in human capital is not always associated with corresponding expenditure on research and development. In this context, it is important to note that, while Africa's education expenditure as a proportion of gross domestic product (GDP) is comparable to East Asia and the Pacific (see figure II), research and development expenditure in Africa in 2015 (0.4 per cent) was almost five times lower than the corresponding figure for the East Asia and Pacific region (2.5 per cent).

3 See Jonathan Rosenthal, "What technology can do for Africa", The Economist, 9 November 2017.
4 See African Union and others, 2018 Africa Sustainable Development Report: Tracking Progress on Agenda 2063 and the Sustainable Development Goals (forthcoming).

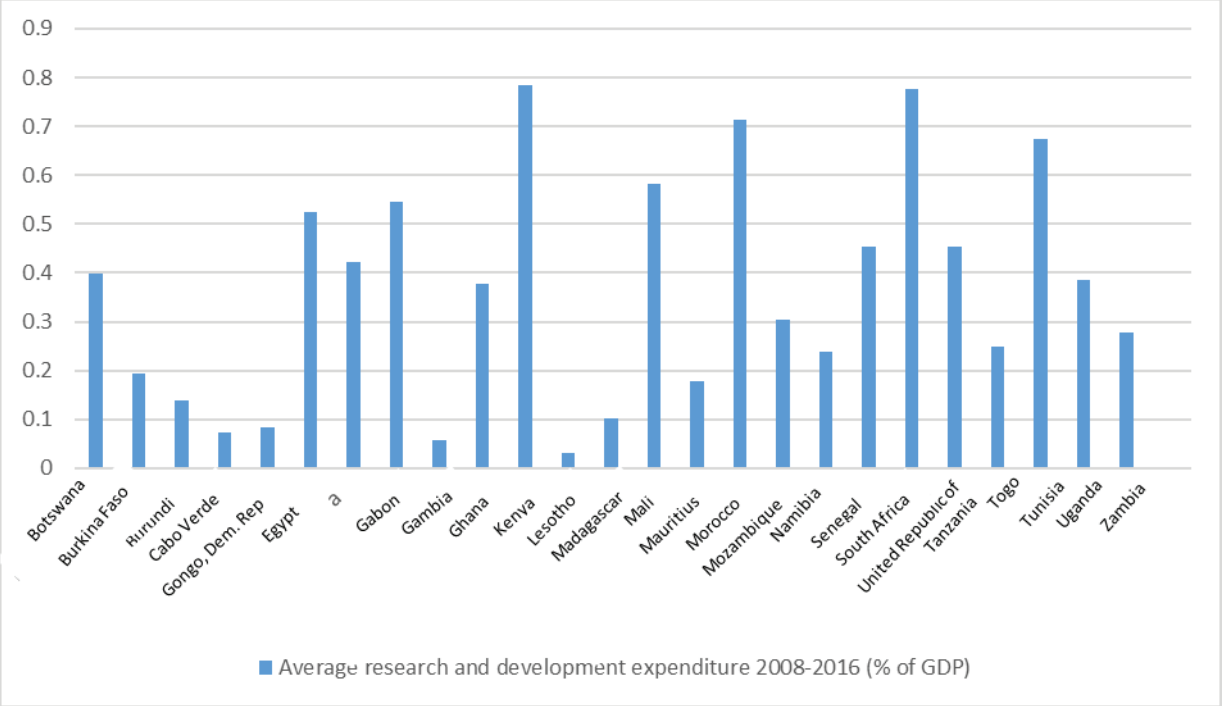
Figure II: Government expenditure on education as a percentage of gross domestic product by region, 2010–2014



Abbreviation: OECD, Organization for Economic Cooperation and Development.

Source: World Development Indicators Database (Washington, D.C., World Bank, last updated 21 May 2018).

Figure III: Average expenditure on research and development as a percentage of gross domestic product by countries, 2008-2016



Source: World Development Indicators Database (Washington, D.C., World Bank, last updated 5 September 2018).

Throughout Africa, North African countries spend a relatively higher proportion of their GDP on research and development (see figure III). The top four countries by expenditure on research and development are Kenya, South Africa, Morocco and Tunisia. With regard to the number of researchers per million population (2010-2015 average), the four African countries with the most are Tunisia (1,637 researchers per million), Morocco (867 researchers per million), Egypt (570 researchers per million) and South Africa (397 researchers per million).4 In patent applications, South Africa, Morocco, Egypt and Algeria

were the top four countries by number of applications filed in 2016.

Role of policies and institutions

Becoming a high-performing country in the area of science, technology and innovation does not happen by accident; it is achieved through a deliberate process of strategic planning. The Moroccan innovation strategy is one example. First launched in June 2009 by the Ministry of Industry, Commerce and the Digital Economy, the strategy is aimed at developing domestic demand for innovation, fostering private and public links and introducing innovative funding mechanisms. Its initial target was to produce 1,000 Moroccan patents and create 200 innovative start-ups by 2014. In addition, the country has created a spin-off and incubation network (Réseau Maroc incubation et essaimage), coordinated by the National Centre for Scientific and Technical Research, which supports technology developed primarily in universities to be transferred to the business realm.5 Moroccan innovations are visible on the world stage in terms of its commitment to renewable energy. The creation of new generation plants (such as Noor 1 at Ouarzazate) is helping the country to reach its target of generating 42 per cent of its energy from renewables by 2020.6

Kenya, another African country with relatively high expenditure on research and development, has a number of institutions set up to encourage innovation throughout the country. The National Commission for Science, Technology and Innovation advises on science and innovation policies at the national level and assists the National Innovation Agency and the National Research Fund in ensuring the funding and implementation of prioritized research programmes. According to World Bank enterprise survey, between 2011 and 2016, 69.3 per cent of Kenyan firms surveyed had introduced a new product or service, while 79.6 per cent reported introducing a process innovation. Both results were the highest in Africa.

The reputation of Kenya for innovation has been boosted tremendously by M-Pesa, a system of mobile money that has made financial transactions easier for many people who may not have bank accounts. The success of this native African technology, which is now expanding to other African markets and even into Asia and Eastern Europe,7 shows that powerful African innovations can be exported from the continent and that there is potential for two-way trade between Africa and the rest of the world in innovation and ideas.

IV. Conclusion

While the infrastructure necessary to support a thriving science, technology and innovation environment in Africa is not yet in place, as in the case of Internet access, progress is being made. Continued investment in communications infrastructure, energy and education will help African economies to increase their participation in the new markets made possible by digital technologies.

In addition to the continued provision of basic infrastructure, African countries should ensure that an appropriate institutional environment exists for innovation to take place. Fostering close links between universities and private enterprises (as in Morocco) and putting in place an agency to ensure coherent national science and innovation policies (as in Kenya) can go a long way towards empowering African countries to produce their own environment-appropriate technologies.

In order to implement the Agenda 2063 objective of fostering a skills revolution taking advantage of science, technology and innovation, African countries can look to the best performers on the continent to see what lessons may be learned with regard to effective policies. Ensuring the coordination of government bodies, academia and the private sector is a key to raising the level of innovation and assisting countries in optimizing their potential for technological innovation.

5 See United Nations Education, Scientific and Cultural Organization, UNESCO Science Report: towards 2030. Available at https://en.unesco.org/USR-contents.

6 See Adam Jezard, "Morocco is building a giant thermosolar farm in the Sahara Desert", World Economic Forum, 1 May 2018. Available at www.weforum.org/agenda/2018/05/morocco-is-building-a-solar-farm-as-big-as-paris-in-the-sahara-desert/.

7 See Vodafone Group, M-Pesa webpage. Available at www.vodafone.com/content/index/what/m-pesa.html.

The present policy brief was prepared under the overall guidance and support of the Director of the Macroeconomic Policy Division of the Economic Commission for Africa. It was coordinated by the Chief of the Development Planning Section of the Macroeconomic Policy Division, Bartholomew Armah, with substantive input by Ben McCarthy.

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Publications, Economic Commission for Africa,
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