United Nations
Economic Commission for Africa

Financing clean and digital technology firms alongside sustainable infrastructure in Africa

Policy Brief

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Summary

This policy brief presents a proposal for the establishment of specialized firms by African States to raise the supply of green technologies and information and communications technologies (ICTs) and related innovations to accelerate countries' progress in achieving the Sustainable Development Goals. It includes examples of successful cases in that regard from developed and developing countries, including some African countries. To link potential developers of technologies with the markets, a greater number of firms specialized in technological innovations are needed to participate in African national and regional innovation systems to stimulate the production and flows of such technologies among the interdependent users. States will mitigate a sizable part of the technical and financial risks that generally hamper innovation in the green and digital technology markets, and create an environment that will attract private investors. The political landscapes, governance structure and technological learning patterns built across Africa over the past decades and the Agreement Establishing the African Continental Free Trade Area are key factors that will potentially help to boost the participation of private investors in this endeavour.

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Background

The growing demand for green technologies, ICTs and related innovations for the implementation of the 2030 Agenda for Sustainable Development far exceeds the supply. Because of this imbalance, both developed and developing countries need to expand their concerted and differentiated efforts in this area and rethink with the objective to set political landscapes and governance structures that drive production and use of such technologies. To bridge the gaps in Africa in the supply of such technologies, the case is made in this policy brief of the need to facilitate the formulation of specialized green technology (also interchangeably referred to as green tech and clean tech) and ICT firms by States collaboratively with relevant agencies from the private sectors alongside sustainable infrastructure development programmes. By linking the potential developers and suppliers of green tech and ICT with the users in the emerging sustainable infrastructure markets, firms can propel a steady flow of technological innovations into the markets and contribute towards sustaining the infrastructure development plans. For the brief, lessons are drawn from the Economic Commission for Africa (ECA) analysis on the innovativeness of African countries with respect to green technologies and ICTs produced to sustain the continent's expanding infrastructure market and contribute towards achieving the Sustainable Development Goals.

In the case of Africa, public intervention makes economic sense partly because the continent is lacking a sufficient number of private firms producing green tech and ICT inventions (beyond the hard sell replications and applications of the existing generic software and algorithms developed by countries from abroad) and moving them into the markets. Some of the reasons behind this are the following: insufficient demand associated with poorly developed financial markets; limited products that may attract funding; very limited amount of funding dedicated to research and development; lack of appropriate standards setting systems for manufacturing; weak enforcement systems for contract laws, investment laws and intellectual property laws; poorly regulated ICT and green technology firms; and information asymmetry.

Green tech and ICT innovations are essential contents of most sustainable infrastructure, notably green infrastructure. A few such cases worth noting are: (a) e-energy, mainly comprised of ICT-based energy systems known to increase efficiency in renewable energy delivery and management, such as the ICT-equipped photovoltaic and digital energy platforms, which includes the mosaic crowd funding community solar projects; (b) high energy efficiency buildings; and (c) sustainable habitats and smart transport systems in urban areas having efficient air and water purification systems. Because green tech and ICT innovations largely contribute towards tackling problems that are global, such as climate change (Sustainable Development Goal 13), oceans acidification (Sustainable Development Goal 14), and environmental health, these innovations tend to suffer from the tragedy of the anti-commons, underinvestment by the non-State actors in which there are concerns that the expected returns on their investment may be difficult to internalize in ways that make business sense. Additionally, as sectors other than the ones for which they are initially intended by the investors have the tendency to swiftly begin to adopt these technologies, the relat-

ed payoff is too difficult to control and internalize fully under weak intellectual property regimes, which are commonly found among the developing countries, including many African countries.

States are in a better position and it is in their best interest to start such firms, mitigating the fundamental risks, such as those alluded to earlier, and paving the way for the development of them. Notably, States should cover a sizable part of the costs required in the early stage of establishment and operation of firms, and carefully ensure that appropriate policy and regulatory environments will help them become operational. The subsequent period after they have been established is generally characterized by the establishment of similar firms, generally from the private sector, albeit the active but invisible hand of the States cannot be discounted in most successful cases. A good illustrating case is the post-Second World War United States Government inter-agency collaboration that led to the initial stage of development of computers, jet planes, civilian nuclear energy, lasers and biotech firms.[1] Another case is the government-led development of the cable and broadband infrastructure industry in China, Japan and the Republic of Korea and in many European Union countries between the 1990s and early 2000s.[2] Developing such firms amid the establishment of the African Continental Free Trade Area supported by strong political, will contribute immensely to States' efforts. In particular, the African Continental Free Trade Area can potentially be a significant supporting factor in optimizing the private sectors' contribution to green infrastructure development and accelerating countries' achievement of the Sustainable Development Goals. With sufficient supply of green tech innovations introduced in the market, aided by an increased number of green tech firms, such areas as agriculture productivity will undoubtedly excel, increasing access to healthier food and greater food security (Sustainable Development Goal 2). Access to clean energy (Sustainable Development goals 7) and clean water (Sustainable Development Goal 6) will also increase significantly. Countries will become more energy and resource efficient and improve waste management plans in priority areas, such as manufacturing, agriculture and land use (Sustainable Development Goal 15), cities (Sustainable Development Goal 11), transport and extractives. Countries' competitiveness and productivity will improve, giving rise to sustainable growth, which is resilient to economic supercycles and risks induced by climate and environmental changes and the rebuilding of natural capital (Sustainable Development Goals 12, 14 and 15), the disbursement of jobs to various income groups (Sustainable Development Goal 8) and the offering of more productive goods and services to consumers and the public.

Sustained by combination of efficient regulatory systems and social policies, digitalization and digital transformation led by ICT innovations can raise the efficiency of governments and result in more productive service delivery by the public and private sectors. Under that transformation, the following is likely to occur:

(a) Human resources take on new more productive and relevant roles in which it will become much more productive and help boost capacity to achieve sustained, inclusive economic growth, full and productive employment and work for all (Sustainable Development Goal 8).

(b) Self-driving cars are likely to be used more frequently, which will help ease unwarrant-

[1] Fred Block, "Swimming against the current: the rise of a hidden developmental State in the United States", *Politics and Society*, vol. 36, No. 2 (2008) pp.169-206.
[2] Martin Fransman (ed.) *Global Broadband Battles. Why the US and Europe lag while Asia leads* (Palo Alto, CA: Stanford University Press, 2006).

ed traffic congestion, mitigate air pollution and reduce related death tolls, and, in turn, contribute towards the effort to achieve sustainable cities and communities (Sustainable Development Goal 11).

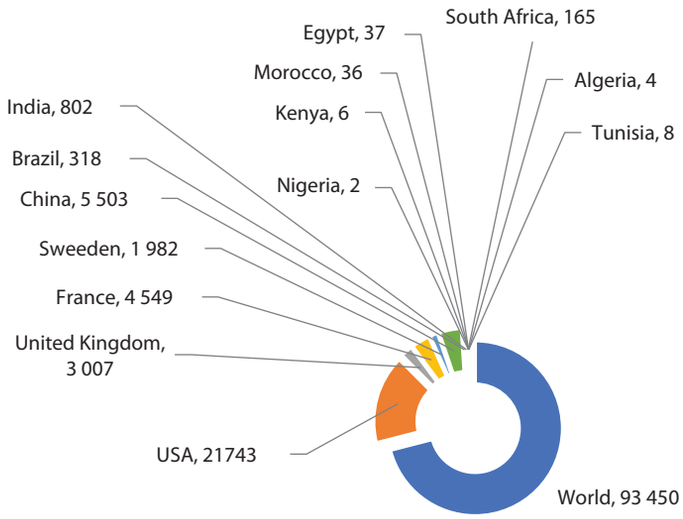
(c) The trade imbalance will very likely be reversed, with fiscal policy becoming more effective in mobilizing revenue to unparalleled levels. By opening up the capital-raising ecosystem to alternative funding platforms, financial innovations will give rise to a financial industry that is much more democratic, fair, transparent, inclusive, and empowering, and inequalities in access to loans will be reduced, with greater access to capital at the lowest price ever, but still yielding high returns becoming available to small- and medium-sized enterprises (Sustainable Development Goal 10).

To harness such opportunities, countries have been generally guided by science, technology and innovation policies aimed at raising capital for research and development at different scales, which has led to unequally distributed green tech and ICT innovations across regions. The highly productive countries are mostly distributed in high-income and some upper middle-incomes economies in North America, Europe and Asia. Because science, technology and innovation policies are poorly resourced, they tend to be overly biased towards the production of basic science and human resources that are less relevant to societal needs, and there is an insufficiently developed market for green tech and ICT research and development outputs. Accordingly, green tech and ICT research and development outputs are limited. Notably, the shares of most African countries in the global stocks of green tech and ICT innovations measured in this brief through patents are negligible.

Figure I shows international patents applications known as Patent Cooperation Treaties (PCTs) on climate mitigation, adaptation and environmental management.[3] South Africa (with triple-digits), Morocco and Egypt (with double-digits each) and Tunisia, Kenya, Algeria and Nigeria (with single-digit each) are the only African countries with marginally noticeable shares. From 2009 to 2013, the contribution of the previously mentioned African countries to the global share of PCTs in green technology and innovations was only 0.28 per cent. With respect to climate change adaptation and mitigation science, South Africa and Kenya were African countries active in this area, albeit their share was marginal globally (figure II) based on scientometrics, which uses scientific publications with high-impact factors. Similar weaknesses occurred in the digital technology innovation, here measured through PCTs in ICTs (figure III) and in related science (figure IV). Only South Africa (with three-digits), Egypt, Morocco, Kenya, Tunisia (with two-digits each) and Algeria (with a single-digit) were the African countries that had international visibility in the global stock of PCTs in ICT. The aggregate contribution of the previously mentioned African countries in the global stock of PCTs in ICT amounted to about 0.15 per cent. Meanwhile, Egypt and South Africa contributed to the global stock of scientific outputs.

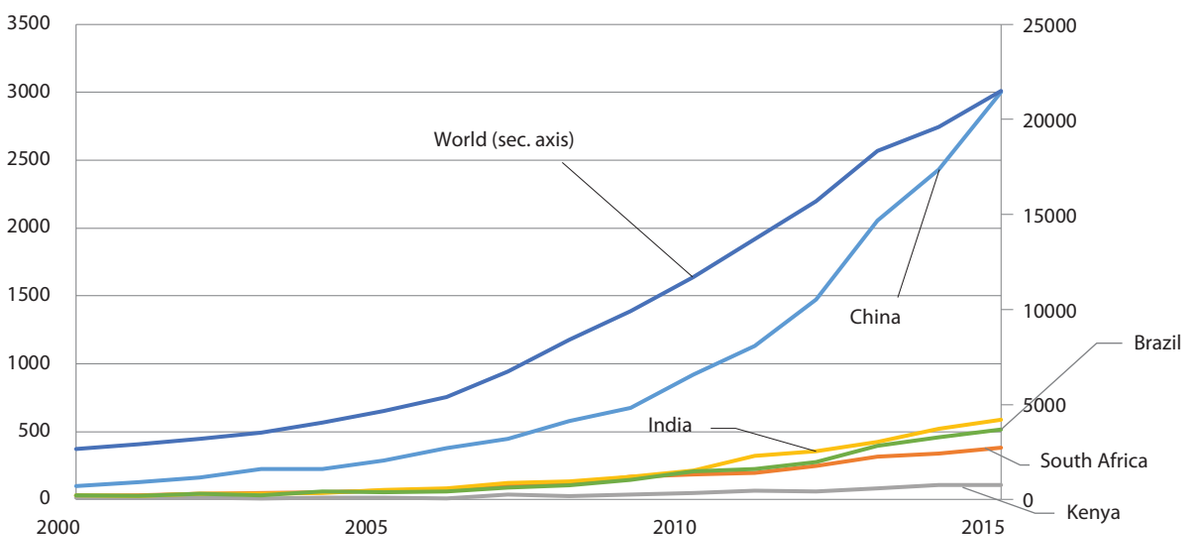
[3] Climate change adaptation, mitigation, and environmental management patents related to the following technological classifications: climate change mitigation technologies related to buildings; climate change mitigation technologies related to energy generation, transmission or distribution, capture, storage, sequestration or disposal of greenhouse gases; climate change mitigation technologies related to transportation; water-related adaptation technologies; climate change mitigation technologies in the production or processing of goods (Organization for Economic Cooperation and Development); and environmental management. Climate change adaptation and mitigation scientific and technical articles were sampled from among the most productive countries in different regions.

Figure I: Climate change and environmental management Patent Cooperation Treaty, 2009-2013



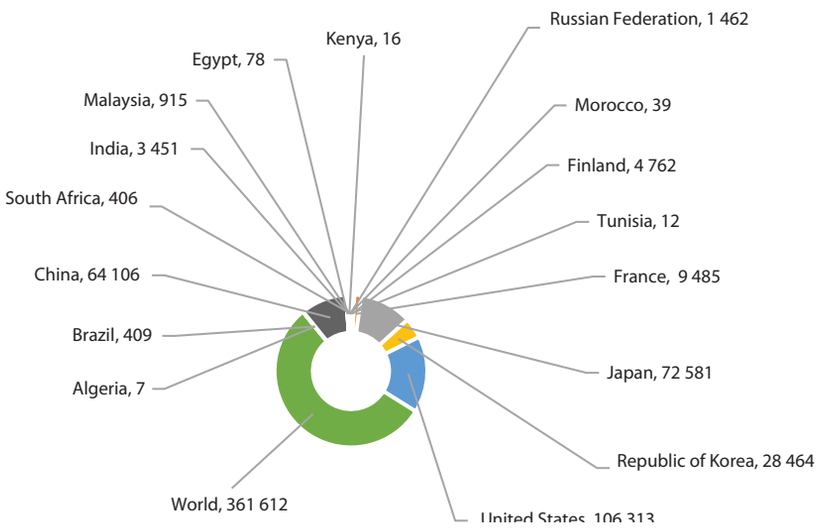
Source: Author' s calculations based on OECD data.

Figure II: Climate change adaptation and mitigtion scientific publications, 2000-2015



Source: Author's calculations based on Thomson Reuters' Web of Science data.

Figure III: Information and communications technology Patent Cooperation Treaty, 2008-2014



Source: Author' s calculations based on Organization for Economic Cooperation and Development data.

Figure IV: Information and communications technology scientific publications, 2000-2015