POLICY CENTER FOR THE NEW SOUTH

THINK • STIMULATE • BRIDGE

POLICY PAPER

April 2019

African Valleys and the Geopolitics of Innovation: Reality, Potential and Challenges

Bouchra RAHMOUNI

PP-19/04

About Policy Center for the New South

Policy Center for the New South, formerly OCP Policy Center, is a Moroccan policy-oriented think tank based in Rabat, Morocco, striving to promote knowledge sharing and to contribute to an enriched reflection on key economic and international relations issues. By offering a southern perspective on major regional and global strategic challenges facing developing and emerging countries, the Policy Center for the New South aims to provide a meaningful policy-making contribution through its four research programs: Agriculture, Environment and Food Security, Economic and Social Development, Commodity Economics and Finance, Geopolitics and International Relations.

On this basis, we are actively engaged in public policy analysis and consultation while promoting international cooperation for the development of countries in the southern hemisphere. In this regard, Policy Center for the New South aims to be an incubator of ideas and a source of forward thinking for proposed actions on public policies within emerging economies, and more broadly for all stakeholders engaged in the national and regional growth and development process. For this purpose, the Think Tank relies on independent research and a solid network of internal and external leading research fellows.

One of the objectives of Policy Center for the New South is to support and sustain the emergence of wider Atlantic Dialogues and cooperation on strategic regional and global issues. Aware that achieving these goals also require the development and improvement of Human capital, we are committed through our Policy School to effectively participate in strengthening national and continental capacities, and to enhance the understanding of topics from related research areas.

Policy Center for the New South

Suncity Complex, Building C, Av. Addolb, Albortokal Street, Hay Riad, Rabat, Morocco.
Email : contact@policycenter.ma
Phone : +212 5 37 54 04 04 / Fax : +212 5 37 71 31 54
Website : www.policycenter.ma

©2019 Policy Center for the New South. All rights reserved
The views expressed in this publication are those of the authors and do not reflect those of their institutions.

POLICY CENTER FOR THE NEW SOUTH

THINK • STIMULATE • BRIDGE

African Valleys and the Geopolitics of Innovation: Reality, Potential and Challenges

Bouchra RAHMOUNI

About the Author

Bouchra RAHMOUNI

Prof. Bouchra Rahmouni is Director of Research, Research Valuation, Partnerships and Events at the Policy Center for the New South. Professor Rahmouni has been a Distinguished Professor at Grenoble Ecole de Management - France since May 2010. She is also an associate professor at New York University - USA, the International Trade and Law Institute of the Pusan National University - South Korea and the Holy Spirit University of Kaslik - Lebanon. She has contributed to a number of collaborative publications including "L'Afrique des nouvelles convoitises ", ELLIPSES Editions, Paris, October 2011 / "Femme et entrepreneur, c'est possible", PEARSON Editions, Paris, November 2012/ "Gouvernance, risques et crises", I HARMATTAN Editions, December 2012. She edited the book "Afrique : Nouvelle frontière de la croissance – Comprendre, Investir et Entreprendre" published by Editions Technip & Orpfys, Paris, October 2015. This work earned her an interview in Forbes on the Savannah Valleys (African Silicon Valleys).

She is co-author of "Géopolitique de la Méditerranée", PUF Publishing, Paris, April 2013 (Translated into Japanese by Hakusui-Sha Publishing) and of "Géopolitique de la condition féminine", PUF Publishing, February 2014. She also edited "Le Maroc stratégique: ruptures et permanence d'un Royaume" published in December 2013 by Editions DESCARTES, Paris. She has published a series of articles in Huffington Post, El País and La Tribune.

Summary

In a globalized world, the ability of countries to innovate is crucial to creating high levels of value added and enhancing economic competitiveness. Silicon Valley, USA, is a development model that many African countries seek to emulate by creating «African Valleys». The success of major US corporations has persuaded a great number of players that new technologies are essential drivers of growth, and several states have implemented policies to stimulate the development of start-ups. Many experts speak of the «geopolitics of innovation» to describe the rivalry driving States as well as corporations to become ever more competitive in terms of Research and Development. Still, challenges remain for ICT development in Africa; these include educational system issues, lagging ICT development, as well as low levels of innovation and difficulty in accessing traditional sources of finance.

African Valleys and the Geopolitics of Innovation: Reality, Potential and Challenges

Introduction

State and company rivalry for R&D and market development by way of technological innovation, is termed by some experts as the geopolitics of innovation. This competition transpires, inter alia, in the race by States to set up innovation clusters.

Recent success stories by firms such as Apple, Google, Facebook and Twitter have persuaded a large number of players that new technology is an essential driver for growth in the world today. Several countries have therefore implemented policies aimed at fostering the development of start-ups, going so far as to create genuine industrial parks for high-tech companies. Such is the case in the Silicon Valley[1], in the United States, that many seek to emulate as it has become a model for development.

In view of such success, many African countries aspire to develop their own «Silicon Valley». What constitutes a «Silicon Valley» and what are the keys for its success? Views differ. Some experts highlight the current success of new technologies, while others prefer to focus on Silicon Valley's unique environment. Six factors are nonetheless at the root of the US technology park's success[2]. These factors include very strong interaction with academia, free movement of capital backed by a significant number of venture capitalists, synergy between all Valley stakeholders, fostering innovation, implementing a stable and rigorous regulatory framework to instill confidence in investors and entrepreneurs and lastly, creating an ecosystem encompassing all necessary instruments for a company to emerge in a single space (engineering, financial services management, banking, marketing, etc.).

Just as elsewhere in Europe or Asia, African countries e.g. Kenya, Morocco, Nigeria, and Rwanda also aspire to develop «African Valleys». Do they, however, have the means to fulfill this vision? Do these meet the conditions necessary to qualify for «Silicon Valley» status? Where does Africa stand in the field of new technologies? These are but some of the questions addressed in this Policy Paper.

Yet, before addressing these questions, it is important to define the concept of the geopolitics of innovation.

1. KENEY Martin, Understanding Silicon Valley: The Anatomy of an Entrepreneurial Region.
2. DOUGLASS John Aubrey, Global Competition: Assessment of the United States' technological advantage and the globalization process, University of California, Berkeley, United States

1. Geopolitics of innovation: soft power, intelligence and governance of R&D policies

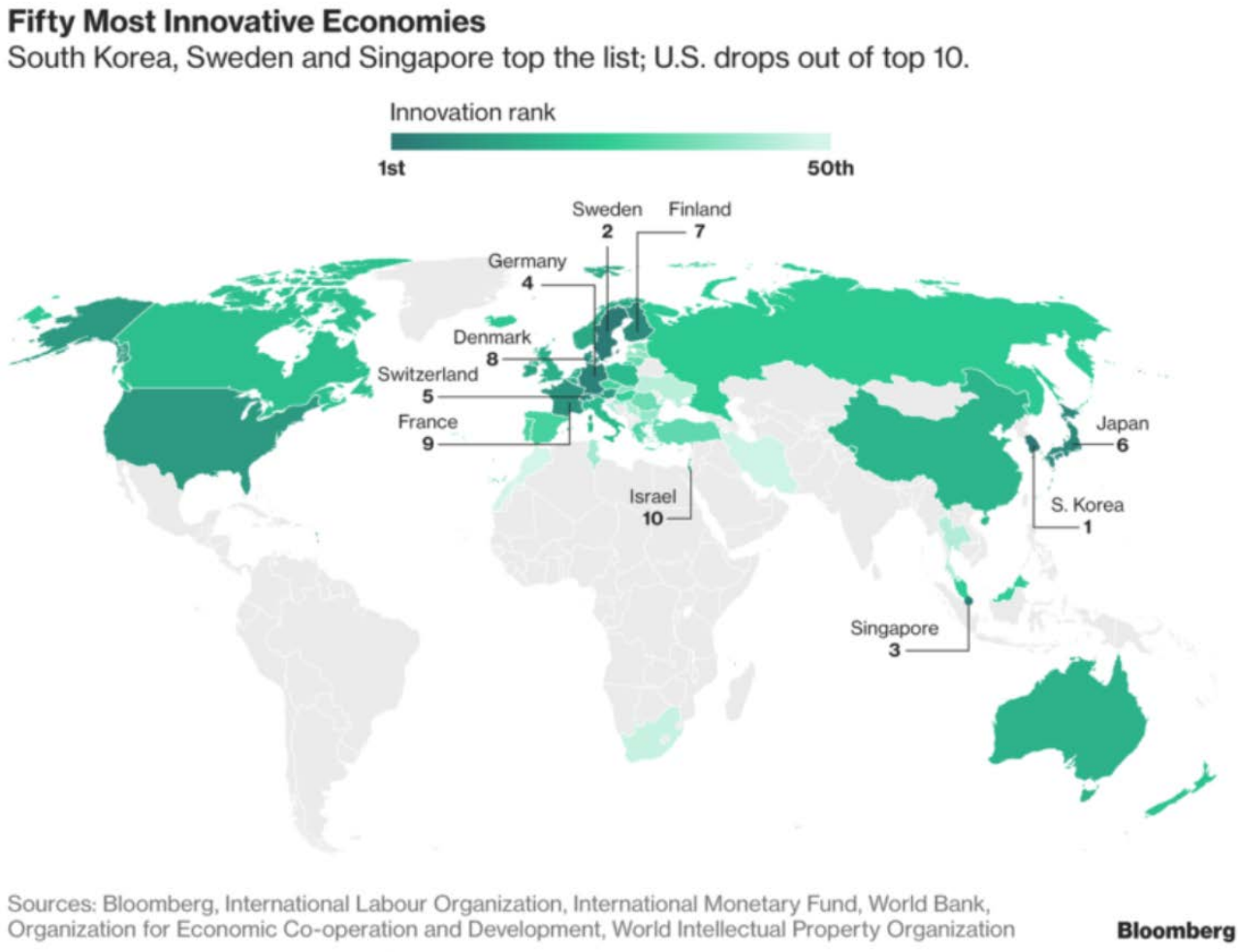
The culture of power includes innovation as a rule and modality of power. This must be clearly understood by countries seeking economic growth, enhanced regional and/or global strategic geopolitical roles and the ability to enter and remain in the race.

More substantial action is required than is currently being deployed in the field of innovation. Let us keep in mind that power is an evolving concept, its evolution is closely tied to innovation and research and development, and that it is oftentimes technological breakthroughs that redefine the contours and means of power.

The main topic at Davos in 2016 was the «Fourth Industrial Revolution» [3]. In other words, the massive technological surge the «world economy» is experiencing. Digital technology, robotics, industrial Internet, automation, supercomputers, biotech and so on are rewriting the landscape of business and the power of countries.

New technologies are now a key factor to the economic development of many countries. In a globalized context, the ability of countries to innovate is key to generating superior value-added and enhancing economic competitiveness[4]. Globally, GDP is a good proxy for a country's power. It is indisputable in our world that knowledge and innovation have a profound impact on the parameters and variables of power[5]. One can hardly expect to play one's part in the geopolitical arena if one has a second-rate economy.

3. Klaus Schwab - Founder and President of the World Economic Forum
4. ATKINSON Robert D., Competitiveness, Innovation and Productivity: Clearing up the Confusion, August 2013 - The Information Technology & Innovation Foundation
5. Innovation, stimulating economic growth? Belfius Research Analysis May 2017



Recently, countries with an understanding of the stakes have embraced the «knowledge economy»[6], with science and innovation now a major priority for a nation's economic future and geopolitical influence[7].

Tackling the geopolitics of innovation is equivalent to depicting processes and power struggles and addressing the issue of intelligence and governance of research policy. This is where the effectiveness and efficiency of bonds between government, research and business operate. Universities' degree of autonomy, perceived «national interest», established values, legal systems, and scientific and technological sophistication all offer both constraints and opportunities.

The competition for innovation is fierce to the point that the constant talk of budgets, GDP percentage spent on research and per capita spending can distort the analysis. This data is certainly necessary, but by no means sufficient. A comparison of the Swiss and French R&D systems shows that the former is much more efficient than the latter. South Korea tops Bloomberg rankings[8], outperforming geographical and demographic giants such as China.

Thus, coherence and governance of R&D systems implemented by States or regions are more

6. ABERKANE Idriss J., Economie de la Connaissance – Fondation pour l'Innovation Politique, May 2015.
7. MENISSIER Thierry, Innovation between invention and conquest. A Geopolitical Perspective on Contemporary R&D, Grenoble Institut de l'Innovation – UPMF.
8. South Korea: The world' s most innovative country in 2018 according to Bloomberg with a total score of 89.28

important than territory size, number of inhabitants and demographics. A conceptual shift in R&D has occurred since the 1980s in countries where innovation is a soft power instrument, involving a review of R&D[9], roles and organization. This conceptual transformation is decisive, as it emphasizes the scale of innovation transforming our societies and the scale of transformation induced by such innovation both in terms of organization and actions, public and private. These countries also realized the need to develop scientific and technological research beyond laboratories, universities, specialized journals, researchers' work, discoveries and innovations. R&D systems are not an extension of existing political, economic or social systems, but their common infrastructure. As such, institutional environments are crucial.

2. R&D Institutional Environment: lessons and best practices elsewhere

Above and beyond the weight of history and established practices and powers, the case of countries such as the United States and Japan shows that science and technology policy requires, first of all, an evolving and integrated, yet highly complex, institutional organization, designed and implemented by a set of institutions associating knowledge and skills from a broad range of fields. It requires resources, both human and financial, powerful universities, as well as a network of design, production and consulting companies, training, management and regulatory bodies as well as a sound legal framework, State and administration. Such an ecosystem can be national, regional or local. The reality is quite different in developing countries, where the notion of innovation is often limited and conflated with industrial innovation policy, research and development investment planning and research strategies devised by states or governments focused on catching-up.

What we see in emerging powers is of a completely different magnitude. These new powers appear of late to be competing with each other in enthusiasm for research and development. In the case of countries such as China, India and Brazil, moving up value chains to boost value-added in industrial production or services necessarily began with imitation, in a context of insufficient resources to stimulate research and development.

Japan went through this phase in the 1960s and 1970s before providing greater added value to products and methods from the West. Brazil[10], India[11] and China[12] clearly grasped that technology transfer is the best way to innovate. In the early 2000s, India planned to acquire 36 French, Swedish or US fighter aircrafts in exchange for transfer of technology, which all three firms agreed to do. When purchasing scorpene-class submarines, India benefited from technology transfer from French company DCN to Mazagon Dock Limited for the manufacture of the bulk of the submarines from 2006 to 2014, while a few more complex parts were produced in Cherbourg. In many cases, access to the Chinese market hinges on technology transfer agreements, as was the case with Areva for the construction of nuclear reactors. All three examples illustrate the need for considerable negotiating flexibility to reach such agreements. Buyouts of innovative firms or subsidiaries with a commitment to form joint ventures for companies wishing to enter a specific territory are ideal ways to acquire

9. COURMONT Barthélémy, Le Soft Power Chinois Peut-il Boulevers les Équilibres Culturels Internationaux, IRIS Associate Researcher and Co-Editor-in-Chief of the journal Monde Chinois Nouvelle Asie.
10. Technology transfer in Brazil: a study of contracts for the exploitation of patents registered by the Brazilian Patent Office - Rita de Cássia Rocha Amorim, Cristina Gomes de Souza February 2011
11. Les transferts de technologie vers les pays en développement - Regards croisés sur l'économie - Edition La Découverte 2009
12. Technology Transfer Institutions in China: A Comparison of Value Chain and Organizational Structure Perspectives - Paul Miesing

new technology. The takeover of IBM's hardware business by Lenovo in 2005, or the creation of a joint venture between a subsidiary of Areva and the Chinese group Dongfang Electrical Machinery to manufacture cooling pumps for nuclear reactors, are transactions that were driven more by technology than by commercial considerations.

Skolkov[13], the Russian Silicon Valley or Kremlin Valley, is a symbol of unprecedented modernization of a Russian economy freeing itself from the yoke of energy revenue dependence. Capitalizing on its intellectual and scientific potential, Russia plans to attract significant foreign investment to this new city, giving the country the impetus necessary for developing science and innovation. While still in the planning stage, the smart city of the future signed key contracts with major international companies such as Alstom, Schneider, Apple, Boeing and Microsoft[14]. The reality is twofold and irrefutable: resorting to these practices assumes that a country is a strong emerging power and that it has the means to pressure companies keen on expanding into a booming market and also assumes that the country is prepared to not burden itself with principles, use legal loopholes or bend the rules.

Indeed, the acquisition of innovation may also involve the misuse of intellectual property rules. India and Brazil are proponents of such strategies in the pharmaceutical sector, producing low-cost generic drugs for developing markets. Brazil rejected patenting of drugs that were considered free goods[15], until 1997, while in India the law protects the manufacturing process, but not the patented molecule[16].

These emerging powers aim to be among world leaders in innovation. They are, however, largely dependent on foreign direct investment[17] and remain for the time being technologically inferior to developed Western countries, which hold long-standing research traditions, infrastructures up to international standards, substantial resources, better trained researchers and, above all, private companies involved both up and downstream of the innovation system.

Country	GDP % devoted to R&D
South Korea	4,6
Israel	4,5
Switzerland	3,4
Sweden	3,3
Japan	3,2
USA	2,8
Singapore	2,2
China	2,1
Netherlands	2,0
Australia	1,9

13. The Skolkovo center is a large-scale start-up incubator offering attractive conditions for research in most technological fields: energy, space, nuclear, biomedicine and IT.
14. LIMONIER Kevin, Geopolitical analysis of power policy stakes: the case of science and innovation in Russia.
15. The Patent Paradox in Brazil and Its Implications for Access to Medicines – Intellectual Property Watch – International IP Policy News.
16. BASANT R., SRINIVASAN S., Intellectual property protection in India and implications for health innovation: emerging perspectives, 2015.
17. LAFARGUE François, From Emerging Economies to Emerging Powers.

UK	1,7
Canada	1,5
New Zeeland	1,2
Russia	1,1
Turkey	1,0
South Africa	0,8
India	0,69
Mexico	0,5

Source: OCDE Science, Technology and R&D Statistics: Main Science and Technology Indicators, 2018.

The issue of innovation infrastructure development in Africa (structural and interconnected components to promote and develop innovation, science and technology) is essential in the current global era of knowledge flow liberation. According to the 2011 World Investment Report[18] produced by the United Nations Conference on Trade and Development (UNCTAD), Africa loses 1% per year in per capita economic growth as a result of its infrastructure deficit. How would the African Silicon Valley model enable the continent to reap the full benefits of technology and innovation?

3. African Valley Description: Context and Review

Africa is becoming a mobile continent. By 2019, monthly mobile data traffic in Africa and the Middle East will exceed that of Western Europe and will equal that of North America[19]. The rapid growth in data traffic will be transformational for the economies of sub-Saharan Africa, with a compounded annual growth rate (CAGR)[20] of 7.7%. Recent years have seen radical changes in Africa's international connectivity[21]. Fiber optic cables were laid over much of the continent and there are now nearly 350 million Internet users and over 900 million mobile users in the region.[22] This therefore allows African nations to aspire to forge local digital economies.

With better Internet access, more powerful devices and cheaper data, Africa is poised to tackle social, environmental and economic development challenges.

Internet's contribution to GDP

McKinsey Global Institute developed the concept of «iGDP», first presented at the e-G8 Forum in 2011, as a quantitative approach to evaluate activities related to the creation and use of Internet networks and services.

IGDP indicators are based on calculating private consumption of goods and services via the Internet, public Internet expenditure for consumption and investment by governments, private investment

18. UNCTAD, World Investment Report 2011 - Non-equity-based modes of international production and development.
19. Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2016–2021, White Paper
20. The Compounded Annual Growth Rate (CGAR) measures the average annual growth rate of an investment over a defined period of time. The Deloitte Consumer Review - Africa: a 21st Century Review
21. WTO, United Nations, Economic Commission for Africa, Promoting Connectivity in Africa: The Role of Aid for Trade in Intra-African Trade Enhancement, October 2017.
22. BEVAN Kate, Sub-Saharan Africa passes the 500 million mobile phone users mark, WorldRemit, 03/02/2018. Available at: https://www.worldremit.com/fr/stories/story/2018/02/03/mobile-money-sub-saharan-africa

in Internet-related technologies and lastly, calculating trade balance in terms of business process outsourcing, international e-commerce and digital goods and services exports.

iGDP 2017 Comparative Table[23]

Country	iGDP 2017
Sweden	6.3%
South Korea	4.6%
Mauritius	2.9%
South Africa	1.4%
Morocco	2.3%
Ghana	1.1%
Côte d'Ivoire	1.3%
Kenya	2.9%
Egypt	1.6%
Nigeria	1.5%
Ethiopia	0.6%
Senegal	3.3%

Source: Table based on compilation of data from the report «Africa is becoming digitalized» - McKinsey, 2017.

The highest value of the iGDP on a global level goes to Sweden (6.3%) at almost twice as high as the top values for African countries, e.g. Senegal, Kenya, Mauritius and Morocco.

Notwithstanding the fact that iGDP in Africa is currently lower than in other regions, the Internet's contribution to GDP is expected to increase in the future and could potentially provide new solutions to the continent's main socio-economic problems.

As a result of the significant recent developments in Africa, many experts believe that the next technology boom is likely to come from there. From Cotonou to Dakar, via Abidjan, Lomé, Yaoundé, Lagos, Accra and Casablanca, the continent is replete with ideas and startups that inspire hope and want to change the continent's image. The «backwardness advantage»[24] means that Africa has gained years of progressive upgrades. It is important to recognize here that the direct transition to mobile networks has boosted Internet penetration to 30% on the continent, resulting in rapid and relatively democratic access to the Web. The adoption of surgical robotics, for example, is occurring faster in Africa than in Europe owing to the lack of operating theaters. The same applies to tele-medicine, where diagnoses are made remotely, as the number of doctors is insufficient, and some regions are too isolated. Renewable energy use using smart grids, as there is no centralized electricity grid and no energy transport system in the sub-Saharan region, is another such example. There already is talk in Africa of connected objects to change the face of the continent, by responding to specific needs of African populations. Necessity is the mother of invention. The continent already boasts major technological innovations in a number of areas, including renewable energies with M-Kopa Solar (Kenya), waste recovery with Afate 3D Printer and Eco_Act Tanzania, health with MEDX eHealth Care

23. McKinsey Global Institute Analysis
24.Notion theorized by the American historian Alexander Gerschenkron and implies that «having fallen behind makes it possible to skip certain steps and immediately adopt more advanced technologies developed on site».

(Cameroon) and logistics with Bifasor (Burkina Faso). There is no shortage of other such examples, which clearly demonstrates that innovation is indeed present.

Indeed, in terms of human capital, young Africans have enormous potential. At Seedstars 2016, an international start-up competition held in Switzerland and bringing together 36 countries, Africa won two of the three prizes. The worldwide prize was awarded to South African company «Giraffe», which offers to reduce costs and recruitment times for candidates compatible with client requirements and organizes interviews. A number of well-known companies now use the service. 2016 was also marked by the launch of the Best Female Entrepreneur Award for «Omni Up», a Moroccan start-up offering Internet solutions for hotels and airports.

Besides, having organized competitions in more than 20 African countries throughout 2017, identified the most promising start-ups and analyzed local ecosystems, Seedstars World 2017 brought together the best entrepreneurs, ecosystem players, mentors and investors from the African continent. Finalists came from Angola, Botswana, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Mali, Mozambique, Nigeria, Rwanda, Senegal, Tanzania and South Africa with projects in Fintech, Edutech, Traveltech, Gaming, E-commerce, Digital services, Health and Biotech.

Local digital entrepreneurship should contribute, in large part, to the battle against precariousness and exclusion in Africa. African digital entrepreneurs have become increasingly adept at creating products for their local markets, which are both sources of inspiration and test beds for extensive scaling up. The ultimate purpose of digital entrepreneurship is the creative production of software and applications by skilled and opportunity-oriented individuals and companies. A new generation of African entrepreneurs is building digital startup communities and developing innovative digital products that will enable businesses and consumers on the African continent to benefit from 21st century technologies. Not only is it the new frontier for growth[25], but could the continent aspire to become the next frontier for digital entrepreneurship?

African Valley: multiple denominations and a single objective

Africa has seen an acceleration of investment in its technology industries[26]. According to a GSMA study conducted in 2016[27], there are already 314 active Technology Parks on the continent, more than 50% of which are located in five countries: Kenya, Nigeria, Egypt, Morocco, South Africa and Nigeria.

It is difficult to decide between countries seeking to build «African Valleys»[28] as many have embarked on the path of innovation clusters.

25. INSEAD Knowledge, Africa: The next frontier for investors?, 2018
26. Open Air African Innovation Research, A Framework for Assessing Technology Hubs in Africa, Working paper January 2017
27. Mobile Communications Policy Manual - GSMA 2016
28. BRIGHT Jake & HRUBY Aubrey, The Rise of Silicon Savannah and Africa's Tech Movement, 2015

Map: Main technology parks in Africa

Mauritius - Smart Island

Mauritius has positioned itself in recent years as one of Africa's leading countries in terms of ICT development and innovation. Driven by a vision of becoming a Smart Island bringing together large companies and technology start-ups, Mauritius has made significant strides in terms of innovation infrastructure and generation of high value-added wealth.

According to Mauritius' National Investment Promotion Agency, the number of start-ups[29] operating in the ICT sector in 2017 is estimated at over 800, while Patents[30] in 2016 reached 114.

South Africa - Creation of a high-tech area

Inspired by the Silicon Valley model, Silicon Cape seeks to attract the best talent and technical entrepreneurs and support them during start-up launch, while ensuring a competitive environment with other global hubs.

The number of start-ups in this region exceeds 512, operating in the following sectors: Fintech, Edutech,

29. OBERLÉ Louis, ICT Economy in Mauritius, ICT, 25/06/2015. Available at: https://ict.io/chiffres-economie-tic-maurice/
30. World Intellectual Property Organization, Intellectual Property Statistics by Country. Available at: http://www.wipo.int/ipstats/fr/statistics/country_profile/profile.jsp?code=MU

Traveltech, Gaming, E-commerce, Digital services, Health and Biotech. Patents for inventions[31] in 2016 reached 4090.

Nigeria - Co-Creation

Nigeria is the main mobile telephony market in the fast-growing West African region, with an average annual growth rate of 6%. The country is to provide 2/3 of all new subscribers in the region by 2020. In 2017, Nigeria had 86 million subscribers, 45.4% penetration rate and 29.9% smartphone adoption.

E-commerce progress is most striking in Nigeria as a result of telecommunications investment development and online purchases, boosting growth in Internet use from 20% in 2009 to 41% in 2014. Nigeria boasts the largest online market, particularly for clothing and footwear in Africa, with sales forecast to increase from USD 104 million in 2014 to USD 1,077 million in 2019[32].

Co-Creation Hub is the first open living laboratory in Nigeria and is a pre-incubation space designed to be multi-functional and multi-purpose, where work catalyzing creative social technology projects takes place. The HUB is to be a venue for technologists, social entrepreneurs, government, technology companies, and influential investors in and around Lagos to create new solutions to Nigeria's many social problems.

Since Mark Zuckerberg visited the Co-Creation Hub in Lagos[33], Nigeria has become a focal point. It is true that Yaba, also a university, has become a reference point for new technologies.

Morocco - Technopark

The Technopark is the greatest concentration of technology companies in Morocco. It has managed in recent years to attract a multitude of major players in the field of entrepreneurship support, which now constitute its ecosystem. Since its inception in 2001, the Technopark has supported more than 900 innovative ICT companies, and currently hosts more than 260 companies consisting of VSEs, SMEs and large companies for a total of 2,000 employees with an average age of thirty.

Technopark represents more than 10% of ICT sector revenue in Morocco.[34] Sectors: ICT, Green Tech, Cultural Industry. 263 patents for inventions[35] were delivered to Morocco in 2016.

Kenya - Silicon Savannah

Nairobi is the cradle of technological innovation in Kenya and the center of the country's thriving «Silicon Savannah»[36] technological ecosystem.

31. World Intellectual Property Organization, Intellectual Property Statistics South Africa: http://www.wipo.int/ipstats/fr/statistics/country_profile/profile.jsp?code=ZA
32. Source: Mobile Economy West Africa 2017 -GSMA
33. Co-Creation Hub Website, Nigeria : https://cchubnigeria.com/
34. Le Magazine du Manager, L'incubateur Technopark séduit les startups marocaines, December 2016.
35. World Intellectual Property Organization, Morocco's Intellectual Property Statistics: http://www.wipo.int/ipstats/fr/statistics/country_profile/profile.jsp?code=MA
36. Learning Journey to Silicon Savannah Hans Stoisser, ECOTEC, Karin Krobath, IDENTITÄTER and Living Lab University of Nairobi

Silicon Savannah is an attractive venue for technologists and investors bringing together innovation spaces, incubation centers and accelerators to find innovative solutions in different sectors: political governance, security, health, banking, agriculture, transport, education. «Silicon Savannah» includes 300 start-ups with over 2000 jobs. Fundraising by 21 start-ups amounted to $92.7 million in 2017. 2020 patents of invention[37] were granted to Kenya in 2016.

Ghana - Innovation Centre

Five innovation centers are integrated in this new Silicon Valley in Ghana. These strategically located innovation centers across the country seek to enable industry and academia to work closely together to meet the needs of the 21st century.

Current projects in Ghana's Silicon Valley include high-speed rail development, tele-medicine programs, renewable energy, power grid improvement, IoT, Technical Science Engineering and Aerospace Technologies. As for Patents for inventions[38] in 2016, Ghana had 117.

Rwanda - kLab (knowledge LAB)

An African Valley worth considering as Rwanda has significant assets, including 8% growth and the second-best business environment on the continent, making it very attractive to investors. Besides, Rwanda has a robust telecommunications infrastructure and has launched a first interesting project: kLab. This has yielded satisfactory initial results with the emergence of companies such as Gira ITC, which manufactures tablets and smartphones similar to HP and Samsung, accessible to low-income consumers via a monthly payment system.

The kLab concept is to offer a space accessible to all, where young people's ideas are transformed into reality. 200 companies were born in kLab, 60 have reached maturity, 4 are market leaders in their sector of activity and 2 have developed internationally[39].

Côte d'Ivoire - Mahatma Gandhi Technology Park

This technology park brings together some twenty ICT companies. Application development, electronic archiving, computer assembly, and electrical cabinet companies are hosted on this site; in addition to training companies and three data centers. The technology park now houses 55 companies[40], and approximately 273 patents for inventions[41] were delivered to Côte d'Ivoire in 2016.

37. World Intellectual Property Organization, Kenya Intellectual Property Statistics: http://www.wipo.int/ipstats/fr/statistics/country_profile/profile.jsp?code=KE
38. World Intellectual Property Organization, Ghana Intellectual Property Statistics: http://www.wipo.int/ipstats/fr/statistics/country_profile/profile.jsp?code=GH
39. Le Point Afrique, Kigali : un fleuron high-tech nommé KLab, December 2017.
40. Village des technologies de l'information et de la biotechnologie de Côte d'Ivoire. http://www.vitib.ci/fr/parc-technologique/152-solektra-cote-d-ivoire
41. World Intellectual Property Organization, Intellectual Property Statistics Côte d'Ivoire: http://www.wipo.int/ipstats/fr/statistics/country_profile/profile.jsp?code=CI

Egypt - Greek Campus

Considered as the first technology and innovation park, Greek Campus offers ultra-modern office space in downtown Cairo. Greek Campus brings together more than 160 startups over a total area of 25,000 m², offering open office space for rent ranging from 10 m² to 1,400 m² and able to accommodate companies of all sizes. With regard to patents for inventions in 2016, Egypt counted about 1052 patents[42].

Future of African technology

Africa today strives to step up to the technology track through these continuously evolving innovation spaces. The expansion of technological hubs will inevitably lead to development comparable to that of Silicon Valley, provided that deficiencies in terms of ICT infrastructure are overcome and technological development, as a driver of socio-economic growth, is harnessed.

The future of African technology thus remains dependent on several human, infrastructural and technical factors (among others), which, if not integrated into an efficient ecosystem, could impede or slow down the implementation of the African version of «Silicon Valley».

4. Innovation clusters up to international standards: challenges and barriers

Africa's Challenges with regard to ICT development are encapsulated in educational system issues, backwardness of ICT development, low innovation and scarcity of traditional sources of finance.

Obstacle 1: Educational system issues

Africa still lags behind other regions of the world in education, from pre-school to university.

Africa lacks sufficient numbers of well-trained teachers and researchers. This shortage is generally attributed to insufficient spending on education and research and development, obsolete infrastructure and program quality.

42. Greek Campus website: https://www.thegreekcampus.com/

Table: Number of researchers/million population in 2018

Country	Number of researchers/million
USA	4255
Mauritius	181
South Africa	432
Morocco	1020
Kenya	225
Egypt	665
Ghana	38
Nigeria	38
Ethiopia	44
Senegal	362

Source: Table based on data compiled from the «How much do countries invest in R&D?» UNESCO 2018 report.

Scientific research is undeniably one of the main pillars of socio-economic development. As such, the number of researchers per country provides an indication of the state of education. Africa still lags far behind on this front.

Contexts within Africa diverge from one country to another. Despite its high potential in innovation, education and capital, Kenya, for example, faces important obstacles, e.g. the lack of synergy between actors and the delay in the Konza City project[43]. In Rwanda, another sub-Saharan African country aspiring to establish a «Silicon Valley», the determination of Kigali's government and access to new technologies are not yet sufficient to overcome shortcomings of the education system[44]. We may also mention other countries such as Morocco or Egypt: both of which lack a university component to improve the training of engineers or IT enthusiasts[45].

A number of African universities are endeavoring to become catalysts for innovation and entrepreneurship through training students and professors for the development of entrepreneurial skills and providing suitable venues to turn ideas into reality. Universities therefore need to build strong bonds with companies and funding providers to help start-ups grow.

Barrier 2: Lagging ICT development

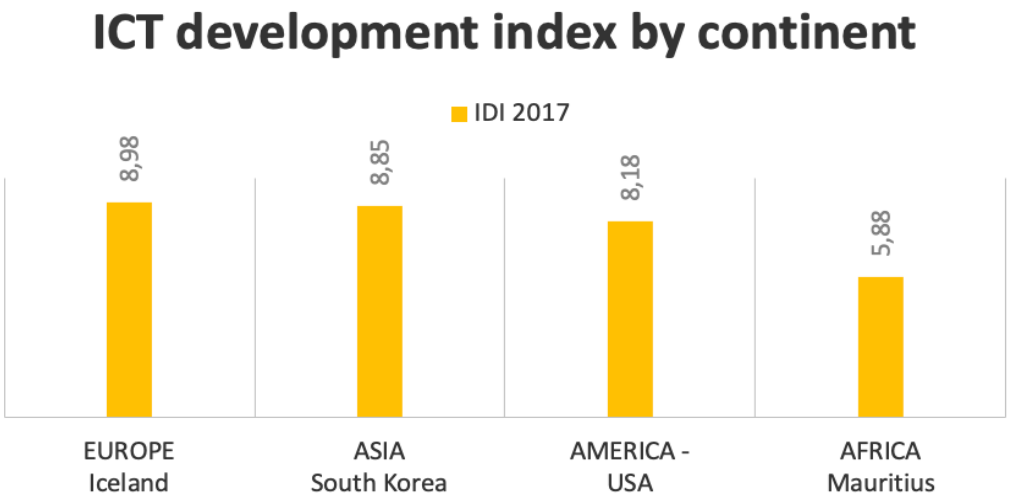
Compared to other regions of the world, Africa lags in terms of information and communication technology (ICT) development. The latest edition of the International Telecommunication Union's (ITU) report Measuring the Information Society shows that Africa's ICT Development Index (IDI) is by far the lowest on average: 2.53, equivalent to less than half the average for other world regions. Only Mauritius has an index above global average in 2015 and only three African states - South Africa, Cape

43. NJANJA Annie, Konza Tech City Gets Sh400m More in Budget, Business Daily Africa, 7/06/2018. Available at: https://www.businessdailyafrica.com/corporate/companies/Konza-tech-city-gets-Sh400m-more-in-Budget/4003102-4600836-mmnvqc/index.html

44. MANIRARORA Jean Népomuscène, Critical and political analysis of the Rwandan economy, The Rwandan, 16/08/2015. Available at: http://www.therwandan.com/fr/analyse-critique-et-politique-de-leconomie-rwandaise/

45. ALMANSOUR Sana, The Crisis of Research and Global Recognition in Arab Universities, Near and Middle Eastern Journal of Rsearch in Education.

Verde and the Seychelles - have an IDI above the average for developing countries (4.12)[46].



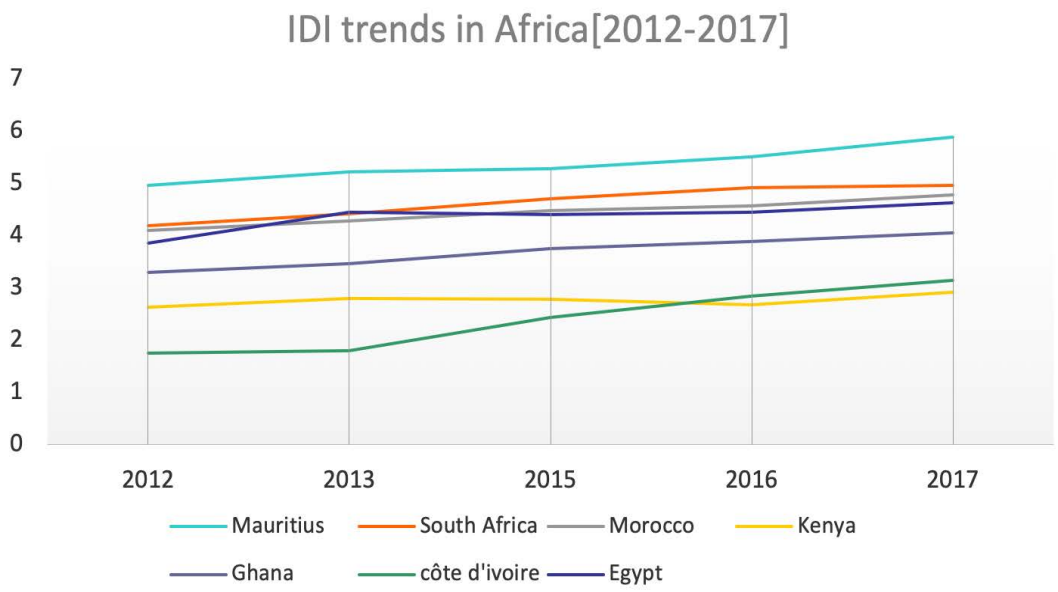
Source: Graph based on data compiled from Measuring the Information Society Report 2017 - International Telecommunication Union

Mauritius, the country with the highest IDI on the continent (5.88 points), depicts a low level of ICT development compared to Europe (8.98 points), Asia (8.85 points) or the Americas (8.18 points).

ICT Development Index (IDI)[47]

The ITU IDI Index is a tool for comparing ICT development levels across countries. Iceland topped the ranking in 2017 with a value of 8.98, followed by six European countries and three countries in the Asia-Pacific region. ICT markets in these countries are competitive and show high levels of investment and innovation.

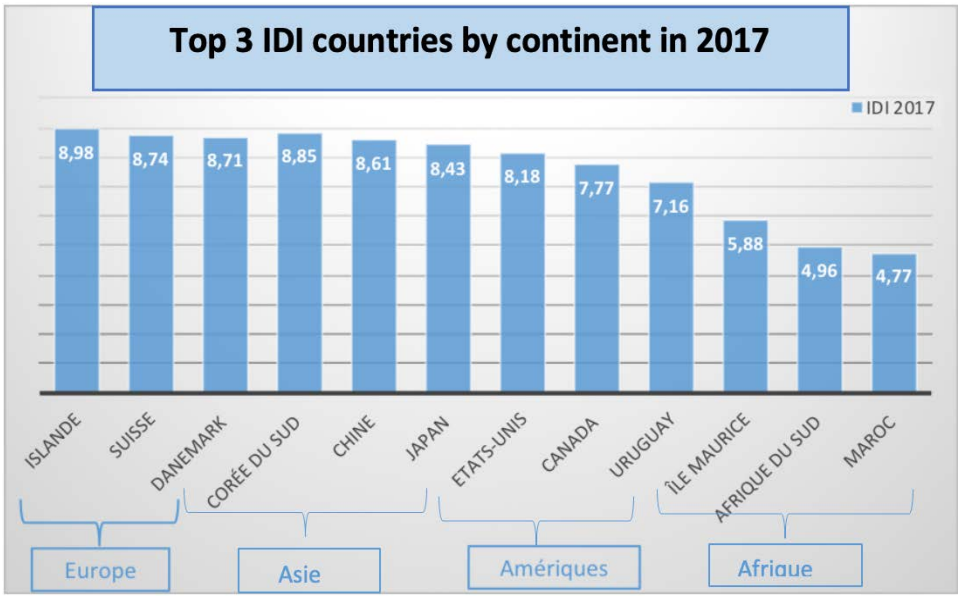
46. Measuring the Information Society 2017 - The International Telecommunication Union
47. The ICT Development Index (IDI) measures the level of ICT development in 175 countries and benchmarks progress over the past few years. This index serves to analyze major trends in the digital divide and highlights the role of ICTs in achieving sustainable development objectives.
The measurement of this Index (IDI) is established by the International Telecommunication Union (ITU) and is based on several criteria, such as access to ICT, ICT use and ICT skills.



Source: Measuring the information society Report – International Telecommunication Union – 2013, 2015 and 2017 Editions

African countries have seen their ICT development index increase over the past five years. This trend reflects the growth in mobile subscriptions and international Internet bandwidth per Internet user.

Three-quarters of African countries are in the bottom quartile and are classified as least connected countries, reflecting a generally low level of economic development. These findings also indicate the existence of a serious regional divide and suggest that a vast majority of countries on the continent need to develop an information society.



Source: Graph based on data compiled from Measuring the information society Report 2017 - International Telecommunication Union

The graph compares the 3 countries with the highest IDI per Continent. This ranking shows that Europe continues to lead the world in ICT development with the highest average score of all regions at 7.50 points. Africa, on the other hand, is left behind and has the lowest average at 2.64 points.

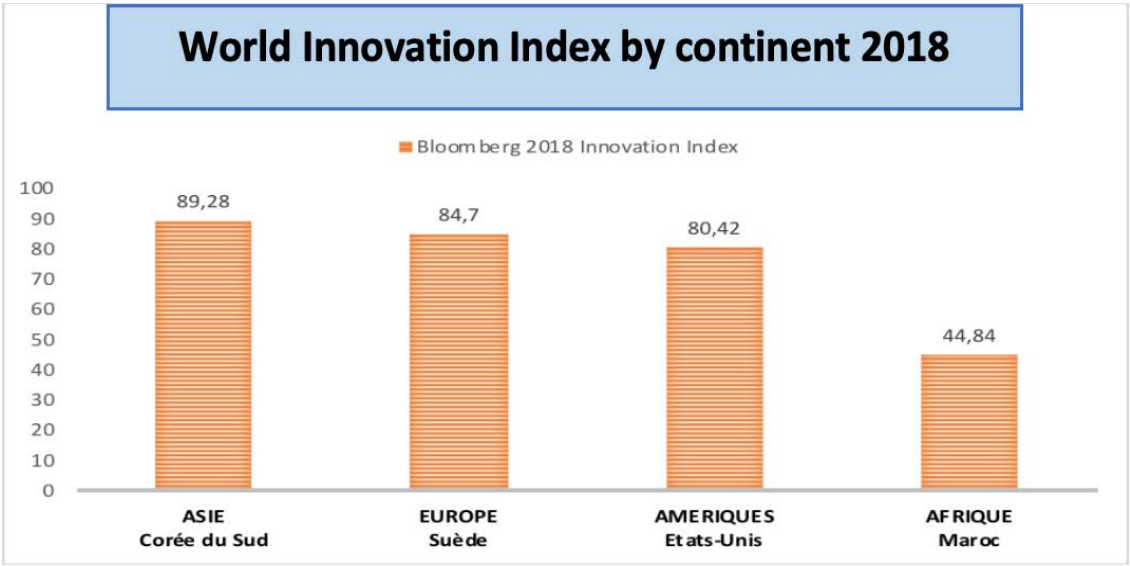
These estimates show the extent to which Africa lags behind the rest of the world in ICT development and highlight the importance of bridging the digital divide that separates the continent from other regions.

Obstacle 3: Weakness of Innovation

The 126-country World Innovation Index ranking is developed by the World Intellectual Property Organization, Cornell University and INSEAD. Based on 80 indicators, the index focuses primarily on the interaction between various agents of innovation systems - companies, the public sector, higher education and society.

Two major sub-indicators for calculating the World Innovation Index are:

- Inputs: institutions, human resources and research, infrastructure, market sophistication and business environment sophistication.
- Outputs: knowledge, technology and creativity



Source: Graph based on data compiled from the Bloomberg Innovation Index Report 2018

Comparing the first worldwide score on the World Innovation Index (South Korea 89.28 points) with that of Africa (Morocco 44.84 points) shows that the level of innovation in Africa is generally low.

Table comparing ICT Development Index and World Innovation Index for different African countries

Country	IDI 2017	World Innovation Index 2017
Mauritius	5.88	34.82
South Africa	4.96	35.80
Morocco	4.77	32.72
Kenya	2.91	30.95
Côte d'Ivoire	3.14	31.12
Egypt	4.63	26.00
Ghana	4.05	31.95
Nigeria	2.60	21.92
Ethiopia	1.65	24.16
Senegal	2.66	27.11

Sources: Graph based on data compiled from the Measuring the information society Report 2017 - International Telecommunication Union and the Global Innovation Index 2017- World Intellectual Property Organization.

The IDI ranking of countries is not exactly the same as the World Innovation Index of the same countries. This is due to the different indicators used to calculate each index. In effect, the IDI and the World Innovation Index intersect in infrastructure and human capital, while the calculation of the World Innovation Index also includes market development, business development, knowledge and technology outcomes and creativity.

The IDI and Innovation indices reveal the considerable disparity between countries at the top of ICT development rankings, namely Europe and Asia, and Africa which, despite a poor situation in terms of economic development and innovation, is witnessing a steady increase in ICT use.

Weak institutions, poor infrastructure, inadequate business development frameworks and insufficient education systems are the main factors behind Africa's lag behind other regions in building innovation infrastructure.

Barrier 4: Lack of funding

The latest report of the UNESCO Institute for Statistics «How much do countries invest in R&D?» reveals global country spending on Research and Development. Top positions go to the United States, China, Japan and Germany, with a budget of over $100 billion devoted to R&D.

Table: R&D expenditure as a % of GDP per country

Country	R&D % expenditure
Mauritius	0.2
South Africa	0.8
Morocco	0.7
Kenya	0.8
Egypt	0.72
Ghana	0.4
Nigeria	0.2
Ethiopia	0.6
Senegal	0.5

Source: Table based on data compiled from «How much do countries invest in R&D?» UNESCO 2018

African countries, with the exception of Kenya and South Africa, remain a long way from meeting the Millennium Development Goal (MDGs) of a minimum 1% of GDP in R&D spending.

So, one can synthesize the barriers in Africa to a lack in the development of research and development mindset, an unfavorable environment and the absence of institutional mechanisms for access to competitive research funds and scientific production.

5. The Learned Africa of Tomorrow: Priorities and Prospects

Clearly, if Africa's future is to be digital, it is essential to foster a dynamic that combines technology with the proximity of knowledge centers, the availability of capital and the creation of a framework up to international standards to attract high-caliber researchers and engineers. However, as things stand today, no African country can comfortably rely on this triptych.

In terms of innovation, Africa must be able to innovate fast enough to move up the global technological frontier. To do so, it must provide effective connections between Government, research and business. Universities' degree of autonomy, perceptions of «national interest», established values, legal systems and standards of scientific and technological culture are all both constraints and opportunities. The objective is to support the continent's transition up the global technological frontier, to better position itself in global value chains and prepare to compete in global markets for goods and services that are both highly-skilled labor-intensive and technology-intensive. The adjustment of production structures, i.e., a transition from unskilled labor-intensive activities based on imitation - or limited adaptation - of foreign products and using imported technologies, to skilled labor-intensive activities based on national innovation, is necessary. The latter require rapid access to information to exploit new market opportunities and foster development of international knowledge networks.

Yet, at the outset, innovation can only be generated by the interactive impact of foreign trade and foreign direct investment. At this stage, it is crucial to know and trust each other. This is where a country's brand can have impact and influence business partners, customers and public opinion.

The most effective influence is one that stems from spreading a highly positive image in terms of innovation and contribution to the knowledge economy. Several countries are exploring the path to such soft power by developing strategies, tools and a country-brand capable of seducing the rest of the world. As such, a «country-brand» gradually breaks away from the intuitu personae and the features of perception and intuition of a people, and moves into a more palpable and concrete space.

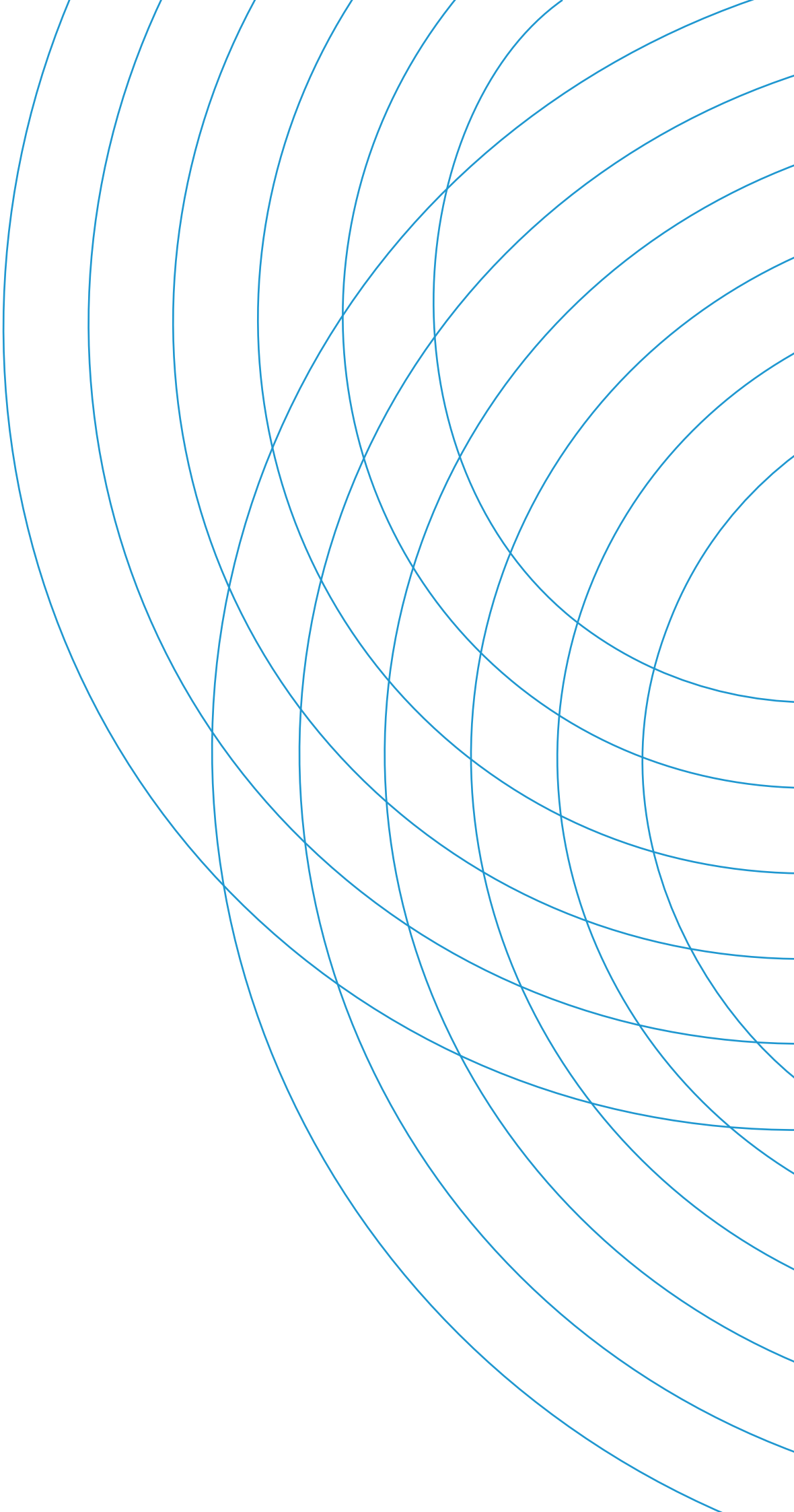
In order to curb the inadequacy of research funding in Africa, an innovative approach to access to funding must be implemented, and it is therefore interesting to consider a financial incentive mechanism based on attracting Research and Development funds through improving the state of institutional and technical research environments, developing university-enterprise partnerships and setting up research funds by the State, foundations, companies and philanthropists.

Overall conclusion

African technology parks are in the midst of proto-emergence, i.e., they bring together all the requirements for emergence and fully playing their role. They will nevertheless have to consider three essential elements to progress from proto emergence to become world-class technology parks, where new technologies make significant economic contribution. These three factors are: access to a knowledge center, global dissemination of African innovations and ensuring a reduced technological footprint on the environment. As previously mentioned, there are still no university centers of excellence in Africa to create high value-added technology parks. Secondly, to ensure major growth benefits, African innovations developed within a given technology park must be disseminated to the rest of the world and replicated outside the continent, while preserving the authorship of African innovations[48]. To ensure the latter, focus will need be placed on establishing common and regional R&D infrastructures and harmonizing technical and regulatory standards for research in Africa, but also on encouraging public-private partnerships across national borders and facilitating the adoption of regional frameworks for the protection of intellectual property rights.

The ecological footprint is becoming an aspect to which particular attention must be paid in the 21st Century. According to United Nations University estimates, 6 million of the 42 million tons of electrical and electronic waste generated in 2014 are directly related to ICT. This fact needs to be considered at every stage of the ICT life cycle so that innovations are in line with a sustainable development logic, while respecting the 3 Ps: Profit, People and Planet. The goal is to establish a reputation advantage beyond the competitive advantage.

48. Africa Capacity Report 2017 - Building Capacity in Science, Technology and Innovation for Africa's Transformation.



Policy Center for the New South

Complexe Suncity, Immeuble C,
Angle Boulevard Addolb et rue Albortokal,
Hay Riad, Rabat - Maroc.

Email : contact@ocppc.ma
Phone : +212 5 37 27 08 08
Fax : +212 5 37 71 31 54
Website : www.policycenter.ma