

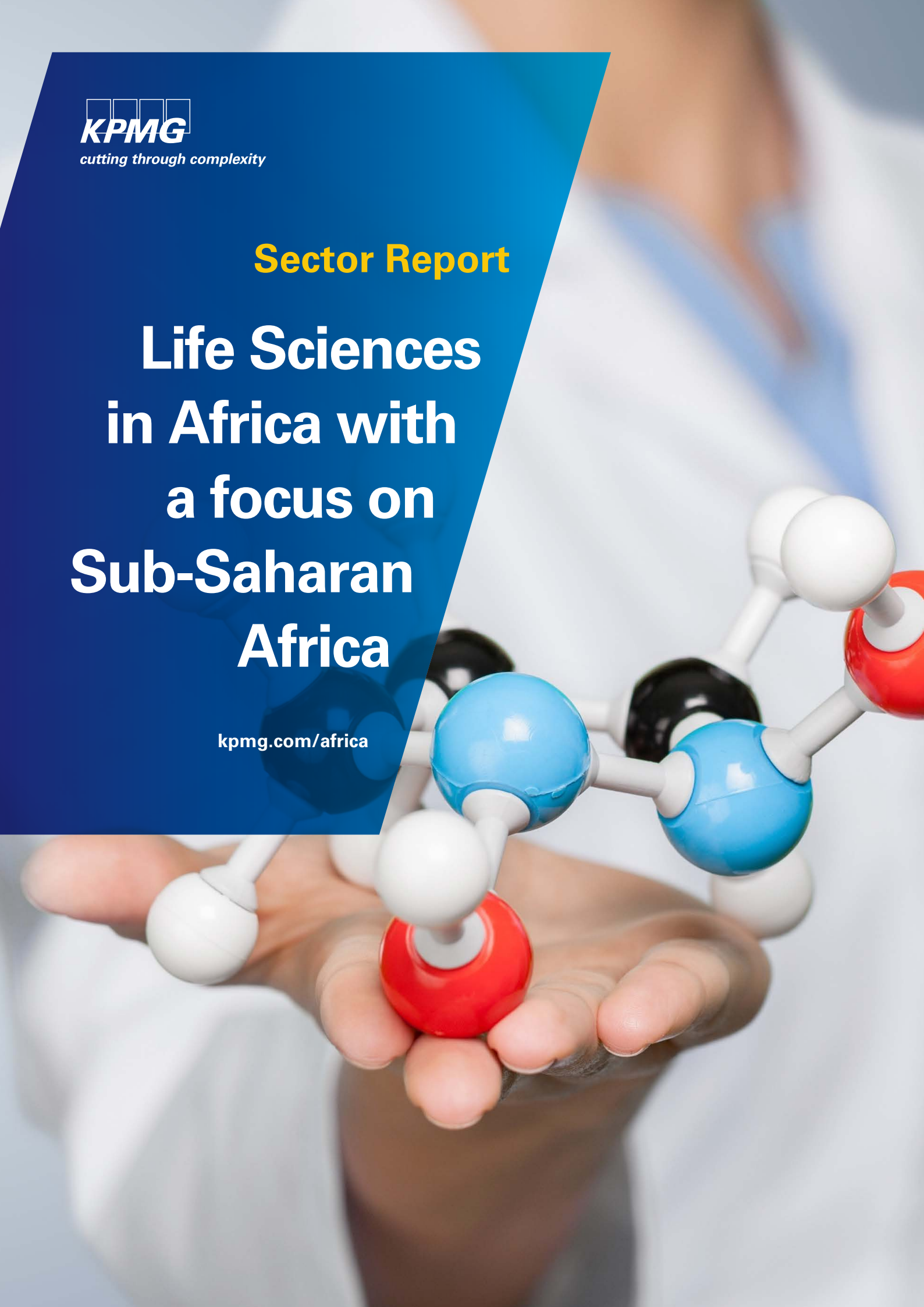


cutting through complexity

Sector Report

Life Sciences in Africa with a focus on Sub-Saharan Africa

kpmg.com/africa

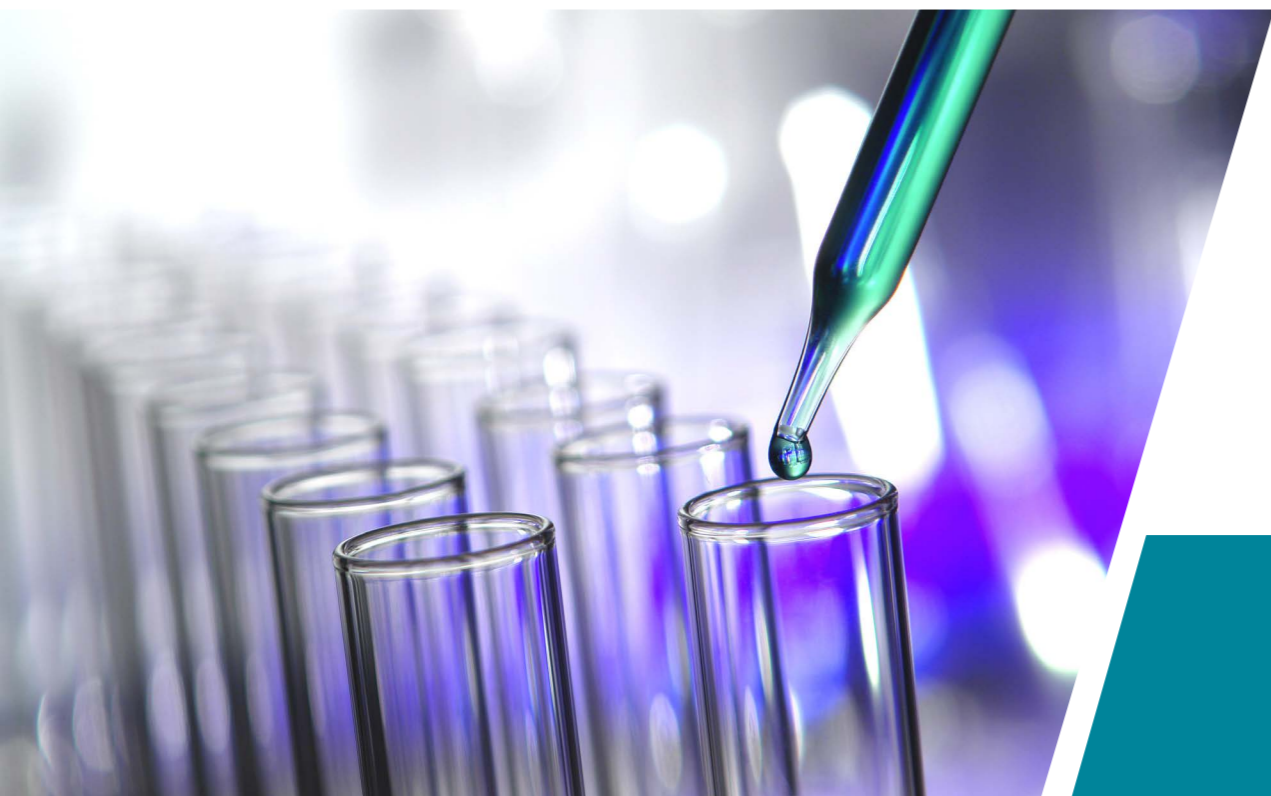


The series has the following reports:

- Banking in Africa
- Private Equity in Africa
- Insurance in Africa
- Power in Africa
- Healthcare in Africa
- Oil and Gas in Africa
- Construction in Africa
- Manufacturing in Africa
- Fast-Moving Consumer Goods in Africa
- Luxury Goods in Africa
- The African Consumer and Retail
- White Goods in Africa
- Agriculture in Africa

Table of Contents

Executive summary	1
Introduction	2
Trends in African Diseases	3
Diseases and Mortality in Africa	3
Research Environment	4
Research Institutions	4
Actual Research	5
Capacity to Innovate	7
Food & Drug Regulation	7
Trends in Life Sciences Industry	9
Pharmaceuticals	9
Medical Devices	13
Pharmaceutical Manufacturing Policy Support	15
Policy Support	16
Government Funding	18
Protection of Intellectual Property	20
Remaining Challenges	21
Conclusion	22
Appendix	23
Sources of Information	24
Contact Details	25



Executive Summary

The following elements are key for the development and expansion of a life sciences sector: strong scientific talent, the presence of universities and research institutions of high quality, a great degree of collaboration between universities and research institutions (both local and international), a high level of innovation, a supportive government and policy environment, and adequate protection of intellectual property rights. We discuss all of these elements in some detail.

Considering that **Africa's current healthcare system gives considerably more prominence to reactive care**, rather than preventative treatment, healthcare infrastructure on the continent will remain inadequate to service the needs of the populace unless adequate policies and reforms are put in place. **The dynamics pertaining to the causes of African mortalities are changing** as the continent develops. The World Health Organisation (WHO) projects that **communicable diseases will only account for some 46.4% of all African deaths by 2030, compared to 70.7% in 2000.** On the other hand, deaths from non-communicable diseases (NCDs) are projected to rise considerably over the next few decades, with the number of mortalities related to cardiovascular diseases forecast to outnumber deaths from complications due to HIV/AIDS by 2030.

We consider the **potential in the life sciences (including pharmaceuticals, medical devices & diagnostics, biotechnology, plant sciences and animal health) market**, while drawing on developmental hurdles and initiatives. While Africa's overall **pharmaceutical manufacturing industry** still has a long way to go, there are a handful of African countries that either already have an established pharmaceutical manufacturing sector, or have the regulatory oversight and manufacturing sophistication necessary to develop the sector.

We look at the **African research environment** in some detail. **Policy support initiatives** in a handful of Sub-Saharan Africa (SSA) countries are discussed, while drawing on an analysis of **fiscal expenditure** on research and development (R&D). The protection of intellectual property has proved to be a particularly troublesome aspect of promoting the pharmaceutical sector in Africa, given that the adoption of **national intellectual property frameworks** and measures are by no means universal across the African region. Even where such frameworks and systems are in place, the degree of **protection of intellectual property** varies between countries. As such, the challenges associated with intellectual property are analysed and discussed.

Introduction

While SSA has attracted significant investor interest due to the region's favourable demographics, the general level of education and skills continues to weigh down the continent's actual human capital. The lack of adequately skilled labour on the continent has hampered the development of certain sectors, such as sophisticated manufacturing and overall research and development. In addition, the underdeveloped nature of many industries requiring such skills has led to a widespread 'brain drain', with skilled labour deciding to pursue opportunities in developed countries. About 10% of Sub-Saharan Africans with graduate degrees emigrate, leaving a comparatively low number of researchers in most African countries, according to UNESCO.

However, new universities have been created in almost all African countries at a rapid pace. Consequently, private higher education institutions have rapidly been established in all African countries. There are now more private institutions than public ones in Africa, and their student enrolment is fast approaching that of public institutions. Furthermore, although the absolute number of students studying abroad increased from 2003 to 2012, the percentage declined from 6% to 4.5% over the same period, indicating that domestic higher education systems are expanding. Regional higher education hubs are becoming preferred destinations for students on the African continent. Ghana and Uganda have become the new target countries for students, and South Africa has remained an attractive destination for students at all educational levels, hosting around 22% of the mobile students from SSA.

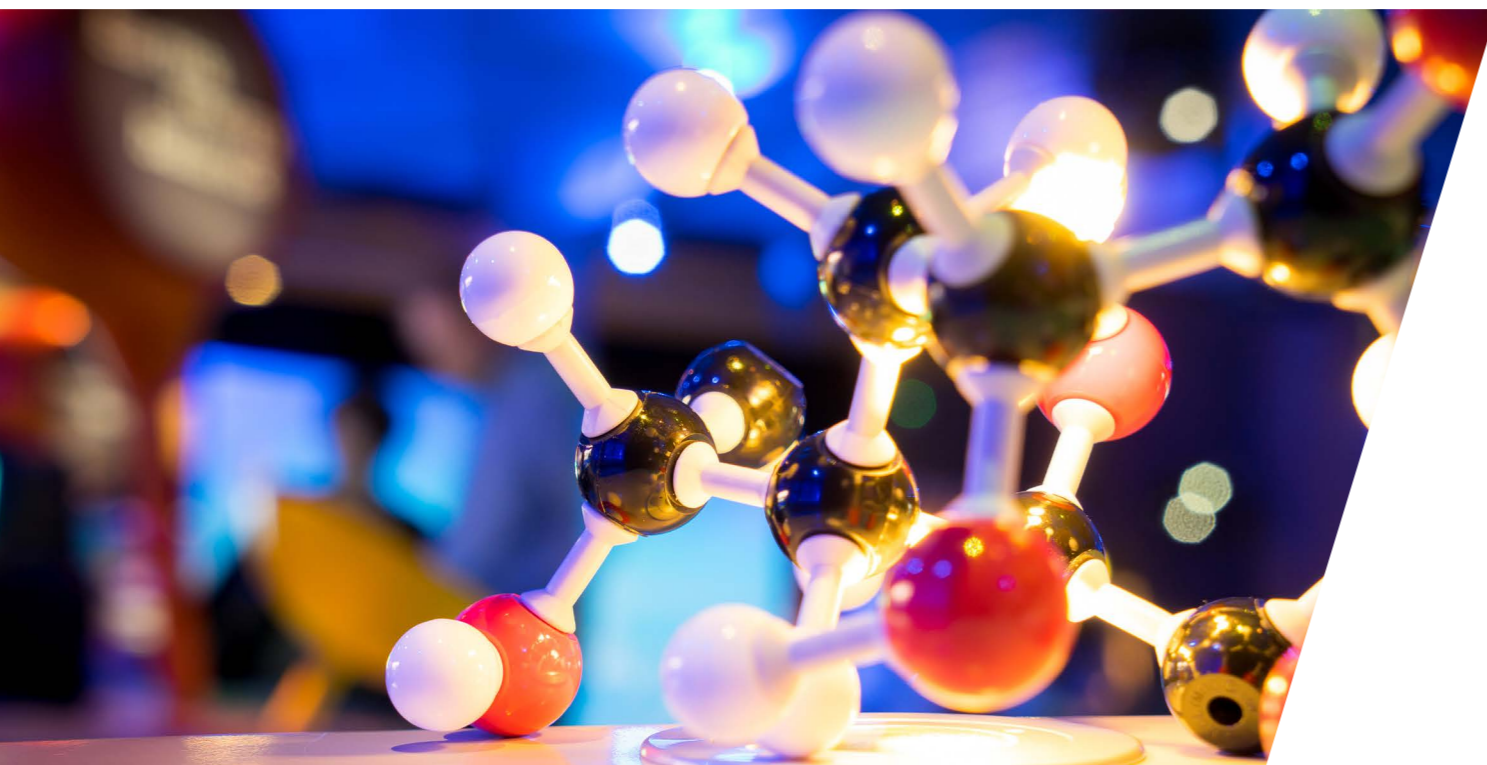
While this document focusses on the life sciences sector in Sub-Saharan Africa (SSA), it is important to note that North Africa, particularly Egypt, Algeria, and Morocco, has a considerably more developed life sciences industry than its southern compatriots, with the exception of South Africa. In Egypt, demand for pharmaceuticals is largely met by domestic manufacturing of generic medicines, with considerable potential for exports to expand in coming years, given the country's favourable geographical location in terms of access to markets in Africa, as well as the Middle East. The manufacturing of generic drugs is also dominant in the Algerian market, with the government actively encouraging local production. That said, imports account for nearly two-thirds of Algeria's total pharmaceutical needs, making the country one of Africa's largest pharmaceutical importers. In turn, Morocco's improving healthcare access has led to increased generic medicine consumption, which has driven expansion of the local pharmaceutical industry. Pharmaceutical giant Pfizer chose Morocco as its gateway to the French-speaking part of Africa, citing the country's infrastructure, skilled workforce, and improved regulations as major benefits. Within SSA, South Africa boasts the most sophisticated and productive research environment. The second-largest economy in Africa leads the continent in terms of the quality of scientific research institutions, while

the country also produces highly-regarded research papers in numerous life science fields.

While still lagging South Africa and the North Africa region, some East Africa nations, particularly Kenya, Uganda, and Tanzania, as well as some West African Anglo-Phone countries, Nigeria and Ghana, and some Franco-Phone countries, notably Senegal, Ivory Coast, and Cameroon, perform relatively well in most indicators. Kenya, East Africa's most sophisticated economy, **records a strong performance with regard to research publications** in all the life science fields under analysis, while also considered to have the second highest quality scientific research institutions on the continent. Moving west, **the Ivory Coast and Senegal boast the continent's third and fourth most highly regarded scientific research institutions**, respectively, while also achieving an admirable performance with regard to research publications. However, **Mauritius is the only SSA country with a tertiary education enrolment rate above that of the global median**, while most African countries have figures less than half the global median.

In addition to the constraints pertaining to the research sector, there are currently many entry and operational hurdles for pharmaceutical manufacturers and research institutions planning to enter the African market. The continent's well documented infrastructure gap, regulatory inefficiencies and the lack of sufficient inputs in the form of labour and intermediate goods hamper the development of the pharmaceutical industry. **The major factor hampering the production of pharmaceuticals is the lack of adequate regulatory oversight**, given the stringent levels of quality that need to be achieved and enforced in the pharmaceutical industry in order to attain international standards. The lack of oversight has led to sub-standard products, as well as counterfeit products reducing market share for domestic producers that actually produce quality pharmaceuticals. Regulatory oversight of the pharmaceutical manufacturing sector in different countries across SSA diverges greatly. On the whole, however, the World Health Organisation (WHO) estimates that the majority of regulatory agencies in Africa lack the basic functions necessary to adequately protect public health.

Furthermore, policy incoherence across government ministries has hindered, rather than promoted, development of the pharmaceutical industries. Policy conformity is constrained by the considerable number of participants in the pharmaceutical manufacturing system, which includes the manufacturers themselves, national medicines regulatory authorities (NMRAs), government ministries, trade associations, and the logistical element. An additional key element pertains to the development of human capital, considering the knowledge-intensiveness of the sector. **Consequently, policy coherence across all these different industries and agencies is paramount to the development of a successful pharmaceutical**

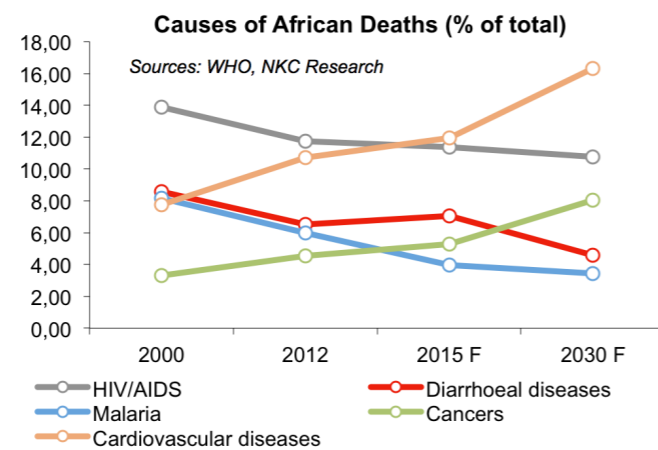
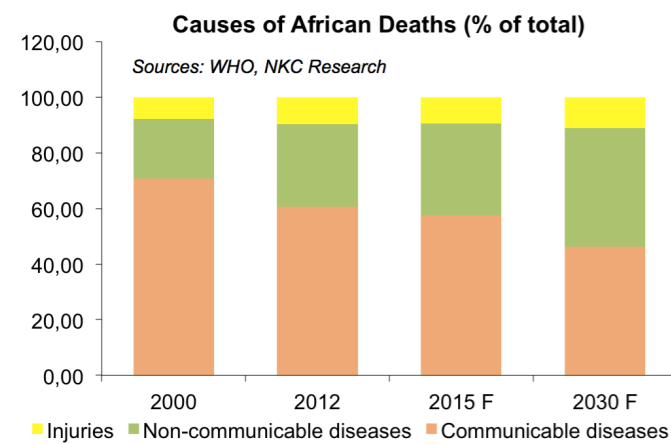


Trends in African Diseases

Diseases and Mortality in Africa

The state of healthcare in Africa is not particularly promising, given that a disproportionate amount of deaths are caused by diseases that have either been eradicated or kept largely under control in most other parts of the world. According to the World Health Organisation (WHO), **HIV/AIDS, tuberculosis and malaria together caused nearly 1.9 million deaths in Africa in 2012, representing some 20% of all deaths.** HIV/AIDS in particular has caused governments and NGOs to mobilise massively against it. Mortality from the virus peaked and began to recede in developing countries in the early 1990s, but began increasing at an

extremely rapid rate in Sub-Saharan Africa from 1990. (By contrast, AIDS mortality in the WHO's Eastern Mediterranean region, which includes North Africa, is the second-lowest in the world, accounting for as many deaths as accidental falls). The virus remains a major killer in Africa, especially compared to other regions. **Africa bears more than 70% of the global HIV/AIDS burden**, with an estimated total of 24.9 million people living with the disease (representing a size more than the total population of Angola) out of 35.3 million worldwide. There are 1.5 million new infections every year in Sub-Saharan Africa.



That said, the **dynamics pertaining to the causes of African mortalities are changing** as the continent develops. According to the WHO, communicable diseases accounted for some 70.7% of all deaths in Africa in 2000. The latest estimate is that this proportion dropped to 60.7% in 2012, and **the WHO projects that communicable diseases will only account for some 46.4% of all African deaths by 2030.** Within this category, deaths from complications due to HIV/AIDS are estimated to have decreased from 13.9% of total deaths in 2000 to 11.7% in 2012, and are projected to decrease further to 10.8% by 2030. Deaths from malaria and diarrhoeal diseases are projected to see even further decreases, from 8.2% and 8.6% in 2000, respectively, to 3.4% and 4.6% by 2030, respectively.

On the other hand, **non-communicable diseases (NCDs) like diabetes, cancer and heart diseases are projected to rise considerably**, with the number of mortalities related to cardiovascular diseases forecast to outnumber deaths from complications due to HIV/AIDS by 2030. Consequently, the manner in which healthcare and life science is approached in Africa needs to adapt to the changing mortality demographics of the continent. Primary reforms that need to be addressed in order for

Africa to update its healthcare system include (but are not limited to) the shift to preventative care, as opposed to the current status quo of reactive care; improved healthcare access via mobile telecommunications penetration; tightened regulations pertaining to counterfeit medicines, care of medical devices, and pharmaceutical distribution; as well as expansion of healthcare insurance and coverage.

At present, the primary focus of African healthcare is on battling communicable diseases and infections, with the hospitals structured to deal largely with short-term treatments. However, improvement in the treatment of HIV/AIDS sufferers has placed increasing emphasis on longer-term healthcare. But the fact remains that **healthcare in Africa is substantially more reactive, rather than preventative.** Fortunately, the rise in non-communicable diseases coincides with a growing African middle class, which implies increased ability to purchase a better degree of healthcare. However, without adequate policies and reforms put in place by the respective government, healthcare infrastructure will remain inadequate to service the needs of the populace, regardless of its financial improvement.

Research Environment

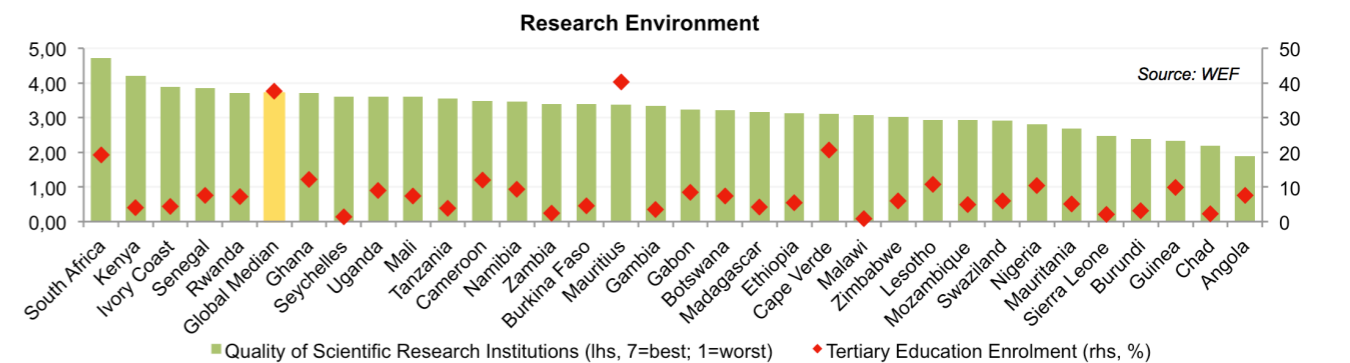
Research Institutions

New universities have been created in almost all African countries at a rapid pace. Between 2005 and 2013, the number of universities in Nigeria increased from 51 to 128, and in Ethiopia from 8 to 21, according to University World News (UWN). Consequently, private higher education institutions have rapidly been established in all African countries. There are now more private institutions than public ones in Africa, and their student enrolment is fast approaching that of public institutions, according to UWN. In addition, more university students from SSA choose to study abroad – including in other African countries – than students from anywhere else in the world, except Asia. Although the number of students studying abroad increased from 204,900 in 2003 to 288,200 in 2012, the percentage declined from

6% to 4.5% over the same period. This is one indication that domestic higher education systems are expanding. Furthermore, according to UNESCO, regional higher education hubs are becoming preferred destinations for students on the African continent. Ghana and Uganda have become the new target countries for students, and South Africa has remained an attractive destination for students at all educational levels, hosting around 22% of the mobile students from SSA. South Africa is the only country in SSA with universities ranked by the QS World University Rankings top 800 index. The University of Cape Town (145th), University of Witwatersrand (313th) and Stellenbosch University (387th) are the highest ranked universities in Africa.

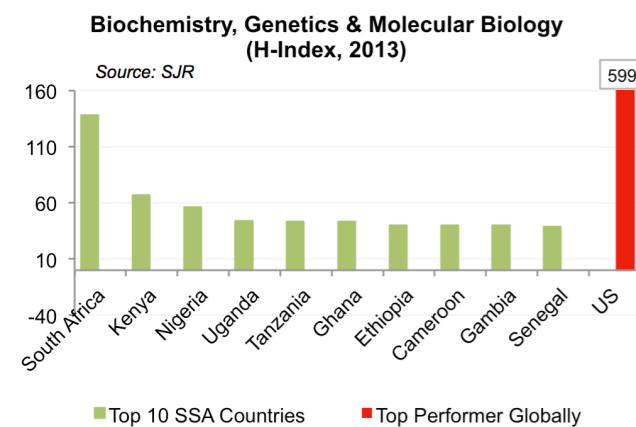
However, some concern has recently been raised that the rapid expansion of higher education services in many African countries has been at the expense of educational quality, with many graduates not adequately prepared to enter the labour market. According to UWN, the tertiary enrolment ratio for SSA was around 6% a decade ago, lower than any other region in the world at the time. This was identified as a severe constraint on economic development, and countries around the continent stepped up efforts to increase tertiary enrolment. Increasing access to existing public universities resulted in soaring student enrolment without due consideration given to the absorptive capacity of the institutions or the available resources. In addition, to ensure equity in access, several universities lowered their entry requirements for targeted groups. The Association of African Universities also notes that a long period of neglect has resulted in a gross decline in the quality of higher education in Africa. According to a 2014 survey by the Inter-University Council for East Africa (IUCEA), at least half of graduates produced by East African

universities lacked employability skills, technical mastery and basic work-related capabilities. The study shows that Uganda has the worst record in the region, with at least 63% of graduates found to lack job market skills, closely followed by Tanzania, where 61% of graduates were ill prepared. In Burundi and Rwanda, 55% and 52% of graduates were perceived to be incompetent, respectively, while 51% of Kenyan graduates were believed to be unfit for jobs. This concern regarding the quality of tertiary education has led to the establishment of bodies to oversee the sector. Over half of SSA countries have already established a regulatory quality assurance agency for higher education, and the remainder are in the process of doing so. On a separate note, data based on the World Economic Forum's (WEF) Global Competitiveness Index report 2014/15 shows that the quality of scientific research institutions in most SSA countries is below that of the global median, with only South Africa, Kenya, Ivory Coast, Senegal and Rwanda outperforming the median figure.



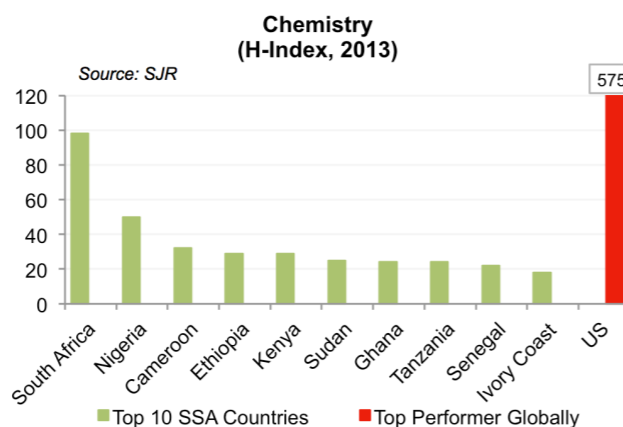
Actual Research

While SSA has attracted significant investor interest due to the region's favourable demographics (young population in the process of large-scale urbanisation), the general level of education and skills continues to weigh down the continent's actual human capital. The lack of adequately skilled labour on the continent has hampered the development of certain sectors, such as sophisticated manufacturing

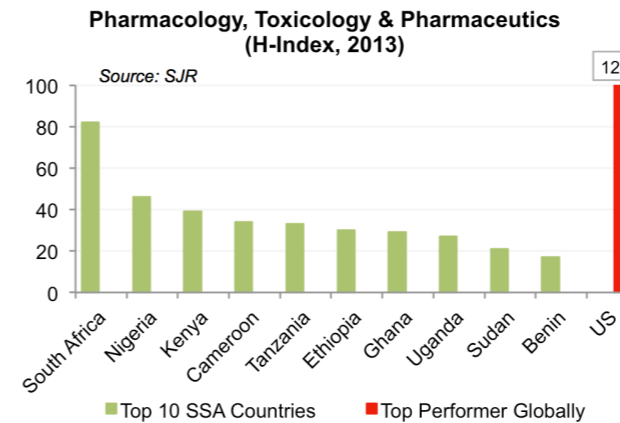


These challenges mean that research output from Sub-Saharan African universities ranks amongst the world's lowest. Only one SSA country, South Africa, makes it to the global top 50 in terms of research output (35th), and less than 10 SSA countries are in the top 100, according to the global SciMago Country Ranking. However, these numbers improve somewhat when including North Africa, with Egypt ranked 42nd, as well as Tunisia (52nd), Morocco (55th), and Algeria (56th) recording decent rankings. The SciMago Country & Journal Rankings (SJR) are based on scientific indicators including the amount of published papers and the amount of citations, which can then be used to assess

and overall research and development. In addition, the underdeveloped nature of many industries requiring such skills has led to a widespread 'brain drain', with skilled labour deciding to pursue opportunities in developed countries. About 10% of Sub-Saharan Africans with graduate degrees emigrate, leaving a comparatively low number of researchers in most African countries, according to UNESCO.

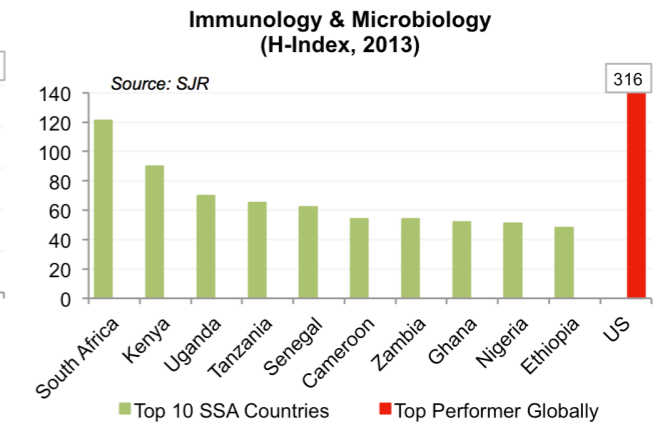


and analyse scientific domains. The SJR's H-Index counts the number of published articles that have at least as many citations in a specific field of interest. For example, if a country only published 100 papers that each have 100 or more citations, the country's H-Index score will be 100. The accompanying graphs show the top 10 SSA H-Index scores in various life sciences fields. The continent's largest economies, Nigeria and South Africa, perform relatively well in these fields. In turn, smaller economies such as Senegal and Ghana perform better than what their economic sizes would suggest. The US is the top performer in all the fields under analysis, and is included for comparison purposes.



It is evident from the above analysis that South Africa boasts the most sophisticated and productive research environment in SSA. The second-largest economy in Africa leads the continent in terms of the quality of scientific research institutions, while the country also produces highly-regarded research papers in numerous life science fields. However, South Africa still lags substantially behind the world leader, the US, in this regard, while proportional tertiary education enrolment in the country is below that of the global median. In turn, the continent's largest economy, Nigeria, is consistently placed within the top 10 SSA countries with regard to publication proficiency, but notably underperforms in both research institution quality and tertiary education enrolment. The combination of a successful publication portfolio and the relatively poor quality of research institutions in Nigeria can possibly be explained by the amount of Nigerian students that study abroad, and then take

Some East Africa nations, particularly Kenya, Uganda, and Tanzania, as well as some franc zone countries, notably Senegal, Ivory Coast, and Cameroon, perform relatively well in most indicators. Kenya, East Africa's most sophisticated economy, records a strong performance with regard to research publications in all the life science fields under analysis, while also considered to have the second highest quality scientific research institutions on the continent. Moving west, the Ivory Coast and Senegal boast SSA's third and fourth most highly regarded scientific research institutions, respectively, while also achieving an admirable



advantage of those linkages when publishing through domestic institutions. A recent study by Brookings finds that between 2008 and 2012, the US approved 4,741 F1 student visas and 1,906 science, technology, engineering, and mathematics (STEM) student visas from applications stemming from Lagos alone. Of the 6,647 student applications from Lagos over the period, around 412 of them were for doctorate degrees. By studying abroad, Nigerian students are able to take advantage of both financial and technological resources in the host universities, thus allowing superior quality publications when the students return to their home universities or domestically-based research institutions. The Brookings paper also finds that the US approved 4,191 F1 student visas and 1,189 STEM student visas from Nairobi (Kenya); 2,416 F1 visas and 767 STEM visas from Accra (Ghana); and 2,078 F1 visas and 989 STEM visas from Addis Ababa (Ethiopia) over the 2008-12 period.

performance with regard to research publications. As would be expected, some of Africa's most undeveloped countries including Chad, Guinea, Burundi and Sierra Leone have the lowest quality scientific research institutions on the continent. However, it is worth noting that relatively large economies, such as Nigeria and particularly Angola, significantly underperform in this regard. Mauritius is the only SSA country with a tertiary education enrolment rate above that of the global median, while most SSA countries have figures less than half the global median.

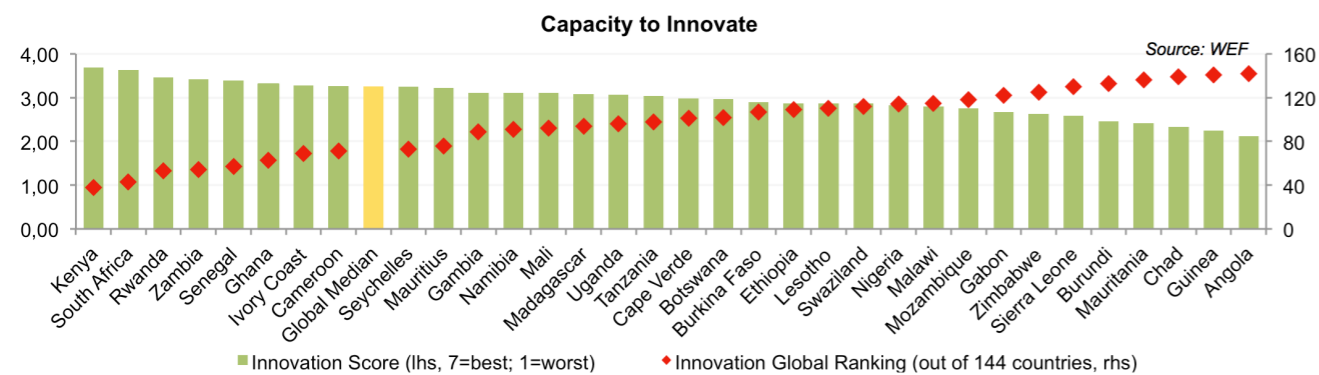


Capacity to Innovate

An important element affecting a country's ability to develop and foster a strong life sciences sector is the economy's capacity to innovate. In the WEF's GCI, the Innovation pillar takes into account various aspects of innovation, including company spending on R&D, university-industry collaboration, and patent applications. We can see from the accompanying graph that several SSA countries perform better than the global median in this regard. As would be expected, the countries that boast relatively strong research environments all feature at the top end of African performances.

Countries such as South Africa and Kenya that have

economic environments conducive to research also have the highest capacity to innovate on the continent. In contrast, countries that do not foster environments supportive of research perform poorly with regard to innovation. Countries that have strong capacity to innovate are not only able to independently make advances in life sciences (and other scientific or technological fields), but are also able to take advantage of advances in other countries. In turn, the inability to innovate hampers the development of any domestic life sciences sector, while also limiting the benefits from external breakthroughs in the industry.



Food & Drug Regulation

Many countries in Africa face significant challenges to effective medicine regulation due to the lack of political commitment and inadequate funding, in addition to a shortfall in infrastructure and human capital, leading to weak regulation. There are currently around 54 national medicine regulatory authorities across Africa. However, regulators' capacity varies highly between countries, with some having almost no capacity at all. In addition, there is significant variation in regulatory requirements and formats, with many countries having a lack of clear guidelines, minimal transparency, and no clear timelines. According to NEPAD, approximately 20% of African countries have fully operational medicines regulation, while around 50% have regulation of varying capacity. In turn, the remaining 30% have either very limited medicines regulation or no effective regulation at all.

Furthermore, medicines regulatory systems and legislation differ from country to country depending on its colonial heritage or other adopted systems. More specifically, most Anglophone countries attempt to adopt systems similar to that of Britain, while most Francophone countries imitate the French system and Lusophone countries adopt systems following the Portuguese framework. In addition, some countries adopt the American system in which both food and

drugs are regulated by the same authority, while other countries separate the activities. Furthermore, some countries incorporate cosmetics and health products under medicines and/or food legislation, while other countries do not.

The African Medicines Regulatory Harmonisation (AMRH, established in 2009) programme works with Regional Economic Communities (RECs) to fulfil the vision of the Pharmaceutical Manufacturing Plan for Africa. The overall aim of the AMRH programme is to support African countries to improve public health by increasing access to good quality, safe and effective medicines through harmonising medicines regulations, and expediting registration of essential medicines. The AMRH intends to coordinate with five to seven RECs covering the entire African continent. The East African Community (EAC) REC has made the most progress after being launched in 2012, while the West African Economic and Monetary Union (WAEMU) REC is expected to launch in 2014. Furthermore, the Economic Community of Central African States (ECCAS) and Southern African Development Community (SADC) RECs are currently in development stages, while the North/North-east Africa REC is still in the discussion stage.



Trends in Life Sciences Industry

Pharmaceuticals

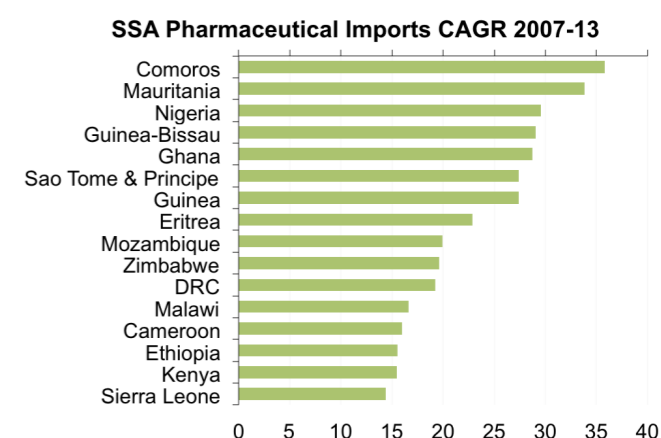
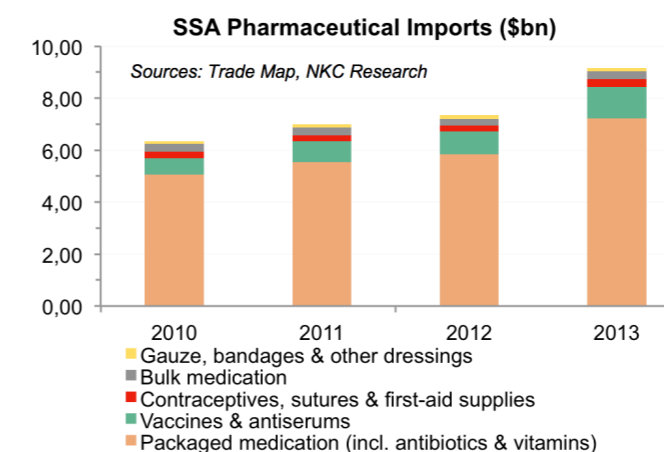
The African pharmaceutical industry is largely undeveloped, both from a manufacturing and innovation point of view. **The supply of African pharmaceuticals remains highly dependent on foreign funding and imports, and around 70% of pharmaceutical products consumed in Africa are imported.** The pharmaceutical industry is mostly composed of small, privately owned companies that serve their national markets. Next to major market-leading multinationals such as Sanofi and GlaxoSmithKline, which traditionally have had a strong presence in the continent, a diverse mix of drug manufacturers have made significant inroads in recent years. Africa now hosts some of the leading global innovators and generic manufacturers. Starwin in Ghana, Sidal in Algeria, Universal in Kenya, and Aspen (one of the top 10 generic manufacturers in the world) in South Africa are home grown manufacturers. In some pockets of the continent, predominantly in North Africa and in South Africa, the status of local manufacturing of pharmaceutical products has gained a sturdy foothold. In 2011, South Africa, Egypt, Algeria

and Morocco accounted for more than half of the continent's pharmaceutical sales. South Africa has a relatively well-developed pharmaceutical industry, which consists of manufacturers, distributors and dispensers forming the supply-chain. South African research-based pharmaceutical companies that previously belonged to either Innovative Medicines SA (IMSA) or the Pharmaceutical Industry Association of South Africa (PIASA), integrated to form a new association named the Innovative Pharmaceutical Association South Africa (IPASA) in April 2013. This created a single entity representing 25 leading pharmaceutical companies operating in South Africa. IPASA currently represents approximately 43% of the pharmaceutical private sector in the country. Overall, 37 African countries have some pharmaceutical production. Significant production capacity is being developed and enriched in Tanzania, Kenya, Uganda, Ethiopia, Ghana, and Nigeria, while Mozambique has recently commissioned an anti-retroviral plant with the help of Brazil.

Pharmaceutical Imports

Almost 80% of SSA's pharmaceutical imports during 2010-13 were classified as medication (including antibiotics and vitamins) packed for retail use. This share of imports climbed to 83.3% when including medication in bulk. The remainder of pharmaceutical imports is comprised of vaccines and antiserums (11.7%), contraceptives, sutures and first-aid supplies (3.5%), and gauze, bandages and other dressings (1.6%). From a global perspective, all-country imports during the four-year period comprised 72.8% in packaged

medication and 75.5% when adding bulk medicines, 20.1% in vaccines and antiserums, some 3% in contraceptives, sutures and first-aid supplies, and 1.4% in gauze, bandages and other dressings. **The only major discrepancy is SSA's tendency to buy more remedial medicines (83.3% vs. 75.5%) and less preventative vaccines and serums (11.7% vs. 20.1%) as a share of its pharmaceutical imports compared to the rest of the world. This suggests that SSA is more reactive than proactive when it comes to health matters.**

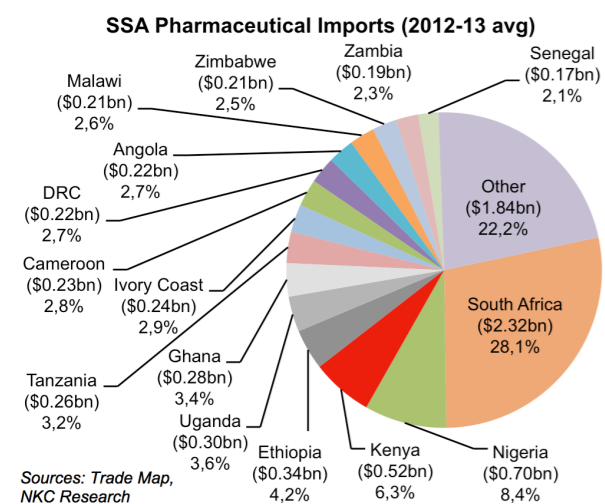


South Africa (the continent's most developed economy and second-largest after Nigeria) **is the largest importer of pharmaceuticals, accounting for 28% of SSA pharmaceutical imports during 2012-13. This is about equal in size to the imports recorded**

by Nigeria, Kenya, Ethiopia, Ghana, Uganda, and Tanzania combined. When also adding Cameroon, the DRC and Angola, these top 10 countries accounted for two-thirds of SSA's pharmaceutical imports.



From a regional and customs perspective, the Southern African Customs Union (SACU, comprising Botswana, Lesotho, Namibia, South Africa and Swaziland) accounted for 32% of pharmaceutical imports. The East African Community (EAC, comprising Burundi, Kenya, Rwanda, Tanzania and Uganda) accounted for 15% of SSA pharmaceutical imports. The West African Economic and Monetary Union (WAEMU, comprising Benin, Burkina Faso, Guinea-Bissau, Ivory Coast, Mali, Niger, Senegal, and Togo) accounted for 11% of SSA pharmaceutical imports.



Market Potential

According to IMS Health forecasts, **pharmaceutical spending in Africa is expected to reach \$31bn by 2017**, reflecting a 9.6% annual growth rate. Spurred by a convergence of demographic changes, increased wealth and healthcare investment, and rising demand for drugs to treat chronic diseases, **this market potentially represents a \$43bn opportunity by 2020**. More specifically, countries that have been identified with particularly promising pharmaceutical growth prospects include Mozambique, Angola, Uganda, Nigeria, Tanzania, and Botswana. According to the African Development Bank (AfDB), **on average around 25% of total health expenditure is spent on medicines in SSA**. More

SSA's imports of pharmaceuticals increased by a CAGR of over 12% during the 2007-13 period. The list of countries recording the fastest increases includes many states in the Central & West African region: the DRC (19.3%), Ghana (28.8%), Guinea (27.4%), Mauritania (33.8%), Nigeria (29.6%), Sao Tome & Principe (27.4%), and Sierra Leone (14.4%). While the region was in the news during 2014 for a record-setting outbreak of Ebola, West Africa has quietly been making progress towards achieving health indicators set out by the Millennium Development Goals (MDGs). These countries reduced under-five mortality rates by 42% between 1990 and 2011. Countries like Cape Verde, the DRC, Ghana, Guinea, Mauritania, Nigeria, Sao Tome & Principe and The Gambia also made progress towards reducing maternal mortality, according to the United Nations' MDG Report 2013. In contrast, pharmaceutical imports have been declining, stagnant or recording only marginal growth in Franc Zone countries like Gabon, Ivory Coast, Niger, Mali and Senegal. "In Cameroon, health statistics have not improved significantly over the last 20 years, and life expectancy has actually decreased," according to the World Bank. In the Franc Zone's other big economy, the Ivory Coast, authorities abandoned in 2012 a short-lived free healthcare system for its citizens due to spiraling costs.

specifically, medicine expenditure represents more than 50% of total health expenditure in Ethiopia and Uganda. Furthermore, while there is some variation between different countries, public spending on pharmaceuticals can reach up to 45% of the government's total health budget in some countries. Despite the strong demand, SSA is still highly dependent on externally developed and procured drugs, vaccines, medical devices and diagnostics. Countries such as Tanzania import about 70% of national drug requirements, while around 80% of HIV/AIDS anti-retroviral finished formulations in Africa are imported. In addition, according to the AfDB, only 38% of essential drugs are available in public facilities in SSA.

Developmental Hurdles

There are currently many market entry and operational hurdles for pharmaceutical and medical device manufacturers and research institutions planning to enter the African market. In addition the continent's well documented infrastructure gap, regulatory inefficiencies and the lack of sufficient inputs in the form of labour and intermediate goods hamper the development of the pharmaceutical and medical device industries. **SSA**, despite having the highest burden and medical device from disease in the world on a per capita basis, and some of the lowest average incomes, **continues to have some of the highest branded drug prices in the world**. Prices are high not because drug companies charge more for their products in Africa, but because distribution is often a larger component of cost for the private payer (almost always the patient) than in other regions. Large-scale local manufacturing in SSA could effectively lower drug prices and distribution costs while meeting quality standards. However, a number of factors

Developmental Initiatives

In order to facilitate the development of a domestic pharmaceutical manufacturing industry, the African Union Commission (AUC) agreed to develop a **Pharmaceutical Manufacturing Plan for Africa (PMPA)** within the New Partnership for Africa's Development (NEPAD) framework in 2005. The aim of the PMPA is to contribute to a sustainable supply of quality essential medicines to improve public health and promote industrial and economic development on the continent. A key partner of the PMPA is the **Federation of African Pharmaceutical Manufacturers Association (FAPMA)**, which was launched in early 2013. The FAPMA currently includes three regional associations, namely the Federation of East African Pharmaceutical Manufacturers, the Southern African Generic Medicines Association, and the West African Pharmaceutical Manufacturers Association. FAPMA currently represents around 231 manufacturers across Africa, most notably in Nigeria (120), Ghana (38), and Kenya (30).

Turning to R&D, the **African Network for Drugs and Diagnostics Innovation (ANDI)** was launched in Abuja in 2008. Its goal is to promote and sustain African-led product R&D innovation through the discovery, development and delivery of affordable new tools, including those based on traditional medicines. An agreement was signed in 2014 to house ANDI at the offices of the United Nations Office for Project Services (UNOPS) in Addis Ababa, Ethiopia. The new hosting agreement paves the way for the continued

prevent rapid development of the industry, namely no active pharmaceutical ingredient (API) production on the continent (only South Africa produces some APIs), irregular and expensive utility costs, a lack of qualified talent, international pricing competition, and a lack of external investment. In addition, **the prevalence of counterfeit products in many regions combined with ineffective regulation decrease the attractiveness of pharmaceutical investments**, particularly for investment in research and development (R&D). The underdeveloped nature of many pharmaceutical industries in Africa is reflected by the amount of mergers and acquisition (M&A) activities. South Africa, boasting SSA's most developed pharmaceutical sector, recorded around 14 M&A deals since 2011 involving pharmaceutical companies, according to PharmaAfrica. In turn, countries such as Kenya, Nigeria, Rwanda, and Tanzania only recorded one M&A deal over the same period, according to the PharmaAfrica dataset.

implementation of ANDI activities in Africa, including establishment of the ANDI Secretariat, five regional hubs, pan African Centres of Excellence (CoEs) in health innovation, as well as a portfolio of projects linked to capacity development across the continent. The ANDI CoEs undertake pharmaceutical R&D, as well as focus on innovation activities on drugs, diagnostics, vaccines, medical devices and traditional medicines. The aim of the CoEs is to encourage closer collaboration among research institutions in order to leverage existing capacity to support product development, while at the same time building new capacity in Africa. There are currently just over 30 African institutions classified as CoEs, mostly located in South Africa (11), Kenya (4), Egypt (4), Ghana (3), and Nigeria (3). Until relatively recently, many multinationals saw the principal African opportunity driven by the purchase of drugs for a small group of communicable diseases, dominated by HIV/AIDS, TB and malaria, by governments and NGOs. However, **increasing individual wealth and accelerating chronic/aging disease burdens have opened out further market segments for privately funded primary care and even for specialist drugs**. The range of products currently manufactured in various African countries remains fairly limited, largely focused on simple analgesics and sedatives, antimalarials, older generation antibiotics, anti-helminthics, first generation anti-hypertensives, anti-diabetics and neuro-psychiatric drugs, nutraceuticals, and cough & cold preparations.

Medical Devices

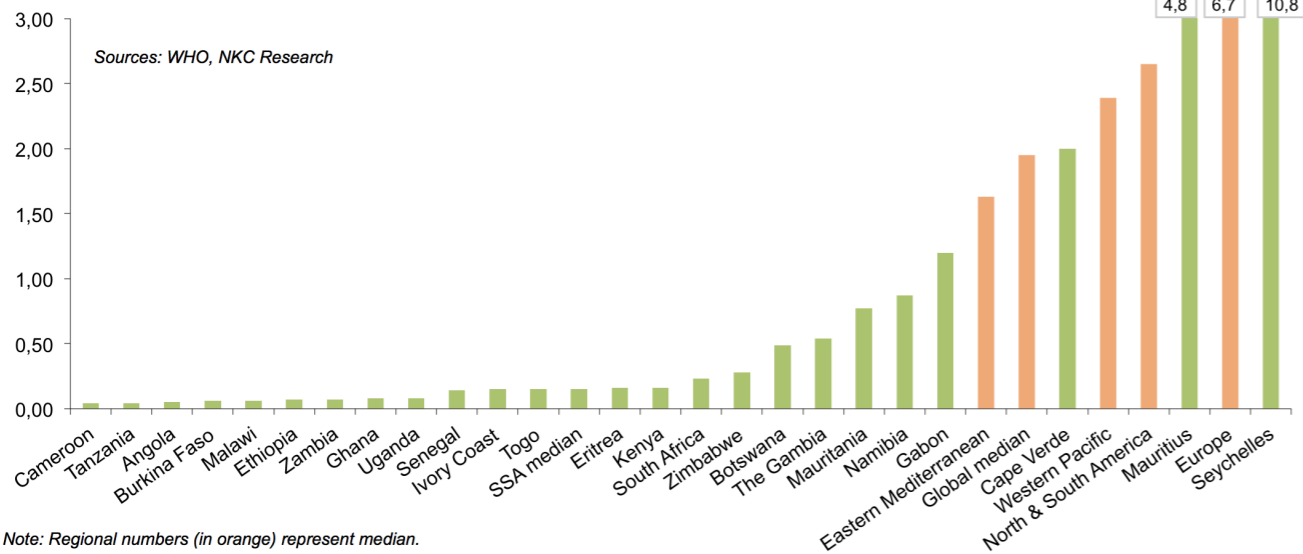
The accompanied graphs (please see appendix for more complete data set) indicate that **SSA lags behind other regions and the world median in terms of its usage of advanced medical technology**. Within the SSA region, **the highest density rates of advanced medical instruments per one million people are found in the countries with small populations**: Botswana, Cape Verde, The Gambia, Gabon, Mauritania, Mauritius, Namibia and Seychelles. It would be easy to dismiss this as a statistical quirk; a small population would allow for relatively higher density readings as one or two state-of-the-art medical facilities would cover almost the entire population. However, the compound annual

growth rate (CAGR) in the value of imports of optical, imaging, measuring, precision, medical & surgical instruments (abbreviated as medical/specialised/technical equipment in the accompanied graphs) to Botswana, Gabon, Mauritania, Mauritius and Namibia were on par or higher than the SSA average of 6.3% p.a. during 2007-13 – showing that these small population countries are also prominent in purchasing trends and not only due to possible quirks in population ratios. Some larger countries (with more than 10 million people) that recorded double-digit CAGRs for these imports during 2007-13 include Cameroon, the DRC, Kenya, Malawi, Tanzania, Uganda, Zambia and Zimbabwe.

There have been steady increases in the importation of medical devices into Africa over the past couple of decades. Electro-medical apparatus imports alone have grown by an annual average of 12.5% since 2001 to reach \$2.2bn in 2013. The importation of orthopaedic appliances and X-ray apparatuses has shown similarly strong growth rates, albeit on a smaller scale. **South Africa is traditionally the SSA region's largest buyer of medical devices**, accounting for 42.5% of the \$5.75bn worth of specialised medical imports during 2013. However, this percentage figure has declined from 50% just prior to the global financial crisis and more than 60% at the turn of the millennium. The next largest buyers of these technologies at present are Nigeria, Angola, Kenya, Ghana, Ethiopia, Uganda, Tanzania, Gabon and Namibia, with **SSA's top 10 importers representing almost 80% of the region's total imports**.

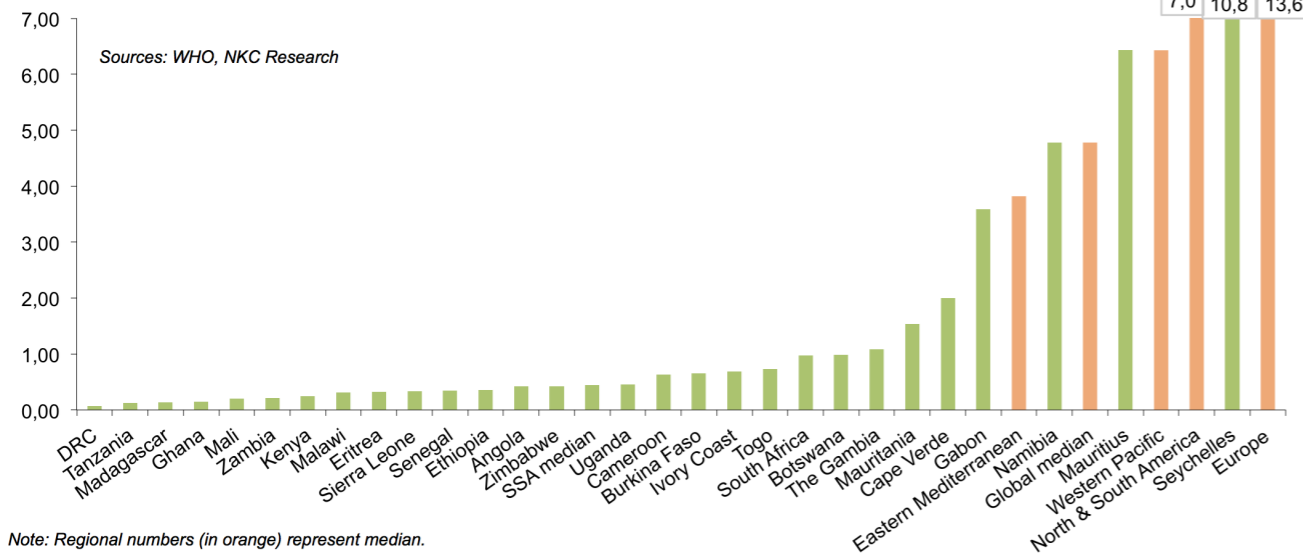
Uganda and Gabon both recorded a CAGR of more than 15% p.a. during 2007-13 in their respective imports of specialised medical equipment. A valid argument would be that at least some of these precision technologies are associated with the oil and gas producing industries, and this will definitely be correct in the case of Angola. However, the developed nature of the healthcare industries (within the SSA context) in many large countries – South Africa, Nigeria, Kenya, Ghana, Uganda and Tanzania – cannot be discounted out of hand. From a supply perspective, Africa's largest providers of these specialised technology imports were South Africa (14.5% of the total), the US (13.7%), Germany (12.2%), China (11.6%), France (7.9%) and the United Kingdom (6.1%), combined providing two-thirds of shipments by value.

Magnetic Resonance Imaging Density (per 1,000,000 people, 2013)



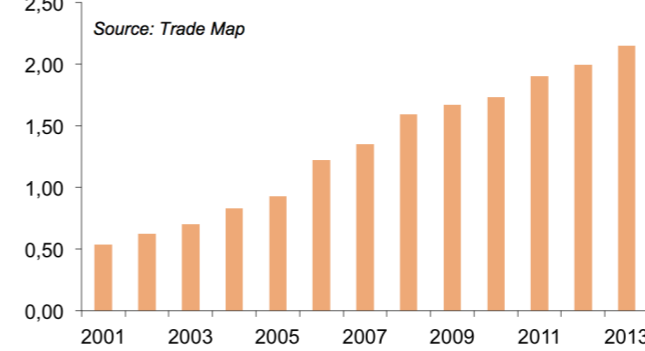
Note: Regional numbers (in orange) represent median.

Computed Tomography Density (per 1,000,000 people, 2013)

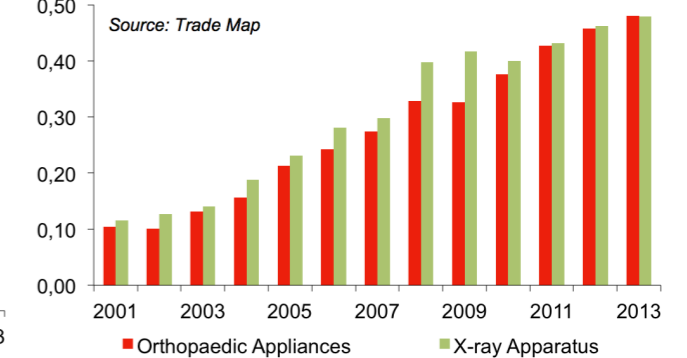


Note: Regional numbers (in orange) represent median.

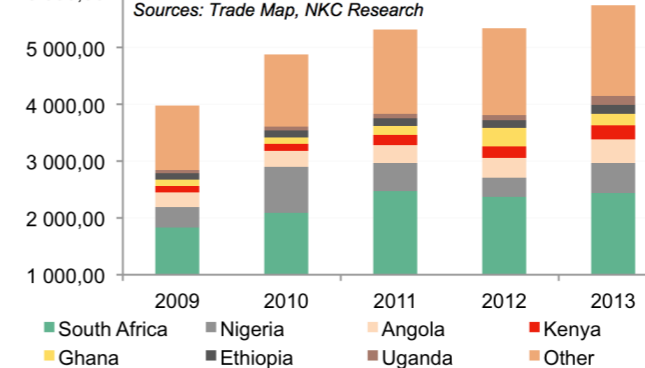
African Imports of Electro-Medical Apparatus (\$bn)



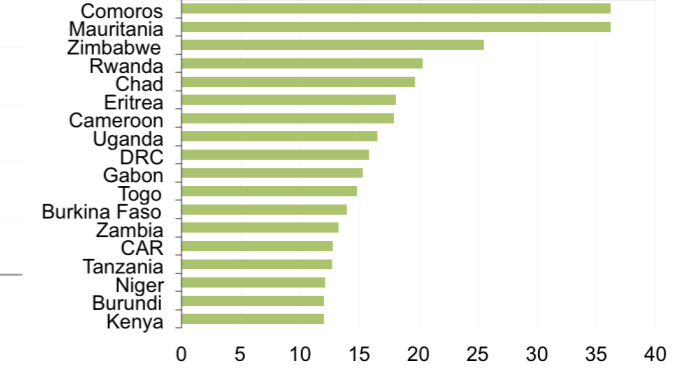
African Imports of Medical Devices (\$bn)



SSA Medical/Specialised/Technical Equipment Imports (\$m)



SSA Medical/Specialised/Technical Equipment Imports CAGR 2007-13



Pharmaceutical Manufacturing Policy Support

The overall manufacturing sector across Africa is widely considered to be the ideal industry to drive economic development in the continent, due to the labour-intensive, export focused nature of the industry. However, most African economies focus on raw-commodity exports, rather than more sophisticated products like pharmaceutical goods. **The importance of a viable pharmaceutical manufacturing sector is growing as structural changes in the African economic landscape accelerate.**

Constraints to the development of the pharmaceutical manufacturing sector stem from several factors, including limited access to finance; limited availability of skilled human resources; inability to access the detailed know-how necessary to implement an upgrading programme or design a new plant; significant costs involved in the proper development of new products; policy incoherence; and underdeveloped supporting industries. That said, **the major factor hampering the production of pharmaceuticals to a quality-level on par with international standards is the lack of adequate regulatory oversight**, given the stringent levels of quality that need to be achieved and enforced in the pharmaceutical industry in order to attain international standards. The lack of oversight has led to

Sub-standard products, as well as counterfeit products reducing market share for domestic producers that actually produce quality pharmaceuticals. Regulatory oversight of the pharmaceutical manufacturing sector in different countries across SSA diverges greatly. On the whole, however, the WHO estimates that the majority of regulatory agencies in Africa lack the basic functions necessary to adequately protect public health.

Furthermore, **policy incoherence across government ministries has hindered, rather than promoted, development of the pharmaceutical industries.** Policy conformity is hindered by the considerable number of participants in the pharmaceutical manufacturing system, which includes the manufacturers themselves, national medicines regulatory authorities (NMRAs), government ministries, trade associations, and the logistical element. An additional key element pertains to the development of human capital, considering the knowledge-intensiveness of the sector. Consequently, policy coherence across all these different sectors and agencies is paramount to the development of a successful pharmaceutical manufacturing sector.

Policy Support

Policies aimed at regulating and developing the life sciences sector differ significantly across countries in SSA. However, governments in the region have increasingly started to acknowledge the importance of their role in formulating policies conducive toward promoting innovation and technological advancement in healthcare, pharmaceuticals and the life sciences sector in general. Regional and multilateral organisations have played an integral role in this regard.

The African Union's (AU) Science and Technology Consolidated Plan of Action, published back in 2006, aligned the science and technology programmes of the AU and NEPAD. According to NEPAD, the plan emphasised the development of an African system of research and technological innovation by establishing centres of excellence dedicated to specific R&D and capacity building programmes. These networks are organised as consortia of country-level institutions that bring their intellectual, administrative, infrastructure and financial resources together. Another AU report, entitled 'Science, Technology and Innovation for Public Health in Africa', highlights the importance of innovation in healthcare and addresses the shortcomings of current policies in bridging the gap between healthcare and economic goals. The 'Freedom to Innovate' report presented to the African Panel on Modern

Biotechnology in 2007, endorsed a more integrated approach to regulation, research, and intellectual property protection across the continent.

An additional area that has historically proven to be problematic for a number of African countries pertains to the pervasiveness of counterfeit medicines. For example, **Nigeria's pharmaceutical market is regulated by the National Agency for Food and Drug Administration and Control (NAFDAC)**, with several anti-counterfeiting measures implemented by the agency, although Business Monitor International (BMI) estimates that manufacturing and corruption translates to an industry that is currently operating at a mere 60% – 65% of full capacity. Ghana's pharmaceutical market is similarly plagued by counterfeiting operations, with the country's unregulated distribution chain for pharmaceuticals further exacerbating the problem.

While Africa's overall pharmaceutical manufacturing industry still has a long way to go, a number of SSA countries (three of which are discussed below) have embraced the recommendations of regional authorities and have strived to address the policy challenges inhibiting the development of the life sciences sector. However, even in cases where policies are in place, issues in relation to the management, coordination and the effectiveness thereof remain.



South Africa

South Africa in particular stands out in terms of its sophisticated level of regulatory oversight. The country's major research-based pharmaceutical companies formed the Innovative Pharmaceutical Association of South Africa (IPASA) in April 2013. The association represents some 25 pharmaceutical companies operational in South Africa. Oversight of

pharmaceutical manufacturing in South Africa falls under the jurisdiction of the Medicines Control Council (MCC). However, a new bill that was submitted in February 2014 is set to replace the MCC with the South African Health Products Regulatory Agency (SAHPRA), which will attempt to fast-track the lengthy process necessary to register new medicines.

Kenya

Kenya adopted the Science, Technology and Innovation (STI) Policy in 2008. The policy provides a framework for a coordinated approach to creating a knowledge-based economy. It also identifies strategic sectors – including the life sciences sector – which would be best suited to drive the transformation to a knowledge-based economy. The policy further aims to promote and coordinate research, technology acquisition, adaptation and diffusion into the national development process and to mobilise funds to support the mainstreaming of STI.

In 2013, the Kenyan president signed into law the Science, Technology and Innovation Act of 2012, to facilitate the promotion, coordination and regulation of the progress of STI in the country; to assign

priority to the development of STI, and; to entrench STI into the national production system. The new law also paved the way for the establishment of the National Commission for Science, Technology and Innovation. The organisation is tasked with granting research licenses and overseeing applications for the establishment of research institutions. The Act also resulted in the establishment of the Kenya National Innovation Agency (NIA) – the national authority tasked with managing the country's National Innovation System and implementing the STI strategy – and the National Research Fund, which is mandated to leverage funds to support the operations and strategic programmes of the NIA.

Ghana

Ghana has long since recognised the importance of the contribution of STI to the country's long-term development and the impact thereof on the provision of healthcare. Ghana also boasts a relatively developed health and biosciences research base with strong foreign linkages supported by an effective regulatory framework. However, while the country's institutions are already involved with research and the commercialisation thereof, certain weaknesses remain.

One of these weaknesses relates to STI policies. Ghana's inaugural Science and Technology Policy

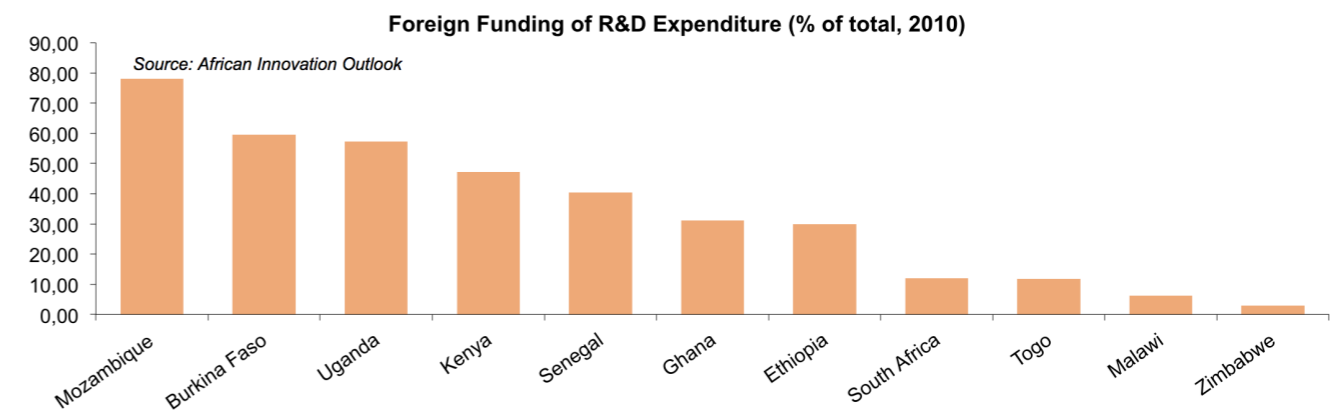
was formulated in 2000 and described measures to overcome development challenges in health and ICT by employing modern innovative technologies, including biotechnology. However, the policy was not implemented effectively and as a result, many researchers were not even aware that the policy even exists. In addition, there is limited coordination of STI policies across different government ministries and policies often have no clear goals or measurable objectives.

Government Funding

R&D Expenditure

A research paper by the University of Stellenbosch in South Africa – published in March 2014 – highlights that countries in SSA have only recently started to prioritise STI related matters. This is especially evident when considering that, according to the World Bank, expenditure on R&D as a percentage of GDP averaged a mere 0.37% in 2010 for a sample of SSA countries for which data was available. This figure will undoubtedly be even lower should only domestic funding be considered, seeing as foreign funding in support of STI development

often represents a significant share of total expenditure in this respect. In fact, when examining the source of funding directed towards R&D in 11 SSA countries, the African Innovation Outlook (AIO) found in a survey conducted in 2010 that foreign funding accounted for an average of 34.2% of total expenditure on R&D in the surveyed countries. Countries that were especially reliant on foreign funds for investment in R&D in 2010 included Mozambique (78.1%), Burkina Faso (59.6%), and Uganda (57.3%).



As part of their commitment to NEPAD objectives, a number of SSA countries agreed to increase expenditure on R&D – with the objective being for expenditure on R&D to reach 1% of GDP across the continent, as endorsed

by the Executive Council of the African Union – and to implement policies to this effect by 2015. However, it is clear that in most cases SSA countries are still some way off from achieving the aforementioned target.

Funding Institutions

Despite the fact that the SSA region's expenditure on STI is still low by international standards, some countries fare significantly better in this regard, at least from a regional perspective. According to the World Bank, SSA countries with comparatively high expenditure on R&D in 2010 included Kenya (0.98%) and South Africa (0.76%). Some countries in the region have also made significant progress with establishing institutions mandated to manage and leverage funding for STI investment.

The research paper by the University of Stellenbosch notes that dedicated STI funding councils are fairly prevalent across countries in the Anglophone tradition (Kenya, South Africa, Uganda, Zambia and Zimbabwe). Francophone countries like Burkina Faso, Ivory Coast and Senegal also have dedicated STI funding councils. However, Cameroon and Rwanda still do not have such institutions; although, Cameroon is in the process of forming a National Fund for Research and Innovation.

Government Spending

According to the AIO, the government plays a more pronounced role in funding of R&D in SSA, as opposed to the private sector. Foreign funding though also plays a very important role in R&D funding. Ghana in particular stands out, with government funds accounting for some 68.3% of total R&D expenditure and foreign funding accounting for a further 31.2%. Overall, the private

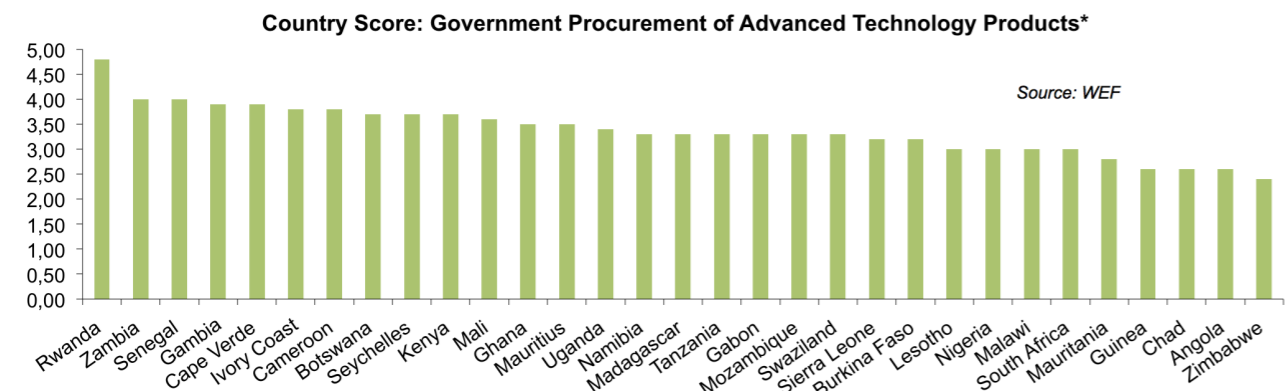
sector doesn't account for a sizeable proportion of R&D expenditure, barring South Africa, where some 40.1% of financing is sourced from the private sector. The AIO references information pertaining to the source of funding of R&D expenditure for six SSA countries, as provided in the table below.

Source of Funding of R&D Expenditure (2010, % of total)						
Country	Business	Government	Higher Education	Private Non-Profit	Foreign	Other
Burkina Faso	11.9	9.1	12.2	1.3	59.6	5.9
Ghana	0.1	68.3	0.3	0.1	31.2	0.0
Kenya	4.3	26.0	19.0	3.5	47.1	0.0
Senegal	4.1	47.6	0.0	3.2	40.5	4.5
South Africa	40.1	44.5	0.1	3.2	12.1	0.0
Uganda	13.7	21.9	1.0	6.0	57.3	0.0

Source: African Innovation Outlook

In its 2014/15 Global Competitiveness Report, the World Economic Forum (WEF) ranked Rwanda fifth out of 144 countries in relation to the 'government procurement of advanced technology products' category. The latter serves as an indicator of the

extent to which government purchasing decisions foster innovation. Other countries that performed comparatively well in this regard include Zambia (25th), Senegal (27th), The Gambia (32nd) and Cape Verde (36th).



* The score was determined via the responses of in-country executives participating in the WEF's Executive Opinion Survey. Survey questions asked for responses on a scale of 1 to 7, where an answer of 1 and 7 always corresponds to the worst and best possible outcome, respectively.

Protection of Intellectual Property

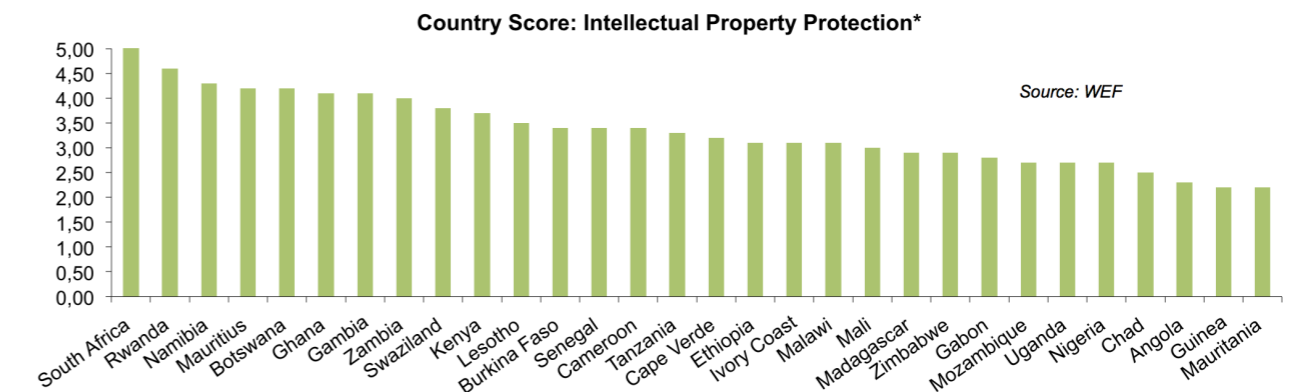
Regional bodies and institutions have taken major strides in recent years in encouraging SSA countries to implement policies and mobilise resources toward the development of life sciences across the region. In doing so, progress has also been made in relation to the protection of intellectual property. A report presented to the African Panel on Modern Biotechnology in 2007 recommended a more integrated approach to the protection of intellectual property amongst AU member

countries. The global community has also had an impact on how the protection of intellectual property is applied in SSA. The Global Strategy and Plan of Action on Public Health, Innovation and Intellectual Property was adopted by 193 World Health Organisation (WHO) member countries in 2008. The plan contains a set of guidelines and recommendations in relation to the application and management of intellectual property, the implementation of which was entrusted to country-level authorities.

Degree of Protection

However, despite these developments on the regional and global fronts, the adoption of national intellectual property frameworks and measures is by no means universal

across the SSA region. Even where such frameworks and systems are in place, the degree of protection of intellectual property varies between countries.



* The score was determined via the responses of in-country executives participating in the WEF's Executive Opinion Survey. Survey questions asked for responses on a scale of 1 to 7, where an answer of 1 and 7 always corresponds to the worst and best possible outcome, respectively.

The WEF, in its 2014/15 Global Competitiveness Report, ranked South Africa 22nd out of 144 countries in relation to the 'intellectual property protection' indicator. The second-best performing SSA country in this respect

was Rwanda, ranked 32nd, followed by Namibia in the 40th position. Countries at the other end of the spectrum include Mauritania (141st), Guinea (140th) and Angola (138th).

Remaining Challenges

An AU report published in 2010 – entitled ‘Strengthening Pharmaceutical Innovation in Africa’ – noted that intellectual property remained one of the essential issues yet to be effectively addressed amongst member nations. The report further highlighted that SSA countries often “lack the skills in intellectual property management and face difficulties negotiating patent conditions.” In addition, intellectual property protection will only succeed if firms believe the state will actually enforce it. As such, even in countries where intellectual property frameworks, policies and the surrounding legislation are in place, poor management and enforcement thereof discourages R&D in health, biosciences and the life sciences sector in general. In turn, this will result in fewer patents being registered domestically. According to the World Bank, South Africa received slightly more than 600 patent applications in 2012, whereas Kenya received only 123 patent applications in the same year. Other countries for which data is available include: Rwanda (40 applications), Ivory Coast (26 applications), Zambia (seven applications) and Madagascar (four applications).

Another challenge developing countries are faced with boils down to implementing intellectual property protection frameworks that provide adequate incentives for R&D in life sciences toward ultimately contributing to the country’s development objectives. In this respect, there is still an on-going global debate on the relationship between intellectual property protection and access to essential medicines and the price thereof. On the one hand, the innovator requires a return on investment, while on the other, poor African households struggle to afford higher priced essential medicines. According to the AU report, public health advocates have increasingly encouraged the implementation of alternative mechanisms to “de-link the cost of R&D from the cost of the product and for prioritisation of public health over profit goals.” Alternative incentives that have been proposed to stimulate innovation include prize funds, health innovation facilities and the UNITAID medicines patent pool. These or other incentives could be applied discretionarily to specific areas – based on a specific disease, product or even target population group – deemed strategically important in attaining the country’s development goals.

Conclusion

Although the obstacles hindering the development of the life sciences sector in Africa may seem insurmountable at first glance, **there are several countries that have an environment viable for a future in the industry.** It is evident from the above analysis that **South Africa boasts the most sophisticated and productive research environment in SSA.** The second-largest economy in Africa leads the continent in terms of the quality of scientific research institutions, while the country also produces highly-regarded research papers in numerous life science fields. Aspen, one of the largest generic manufacturers in the world, is based in Africa’s southern-most country. Furthermore, South Africa clearly has the most sophisticated pharmaceutical sector, both in terms of regulatory oversight and mergers & acquisitions of pharmaceutical companies. In East Africa, **Kenya is considered a rising star in the life sciences sector.** Kenya boasts four African Centres of Excellence (CoEs), the second-most in SSA after South Africa. On the biotechnology front, some six genetically modified crops have already been planted in the East African powerhouse. Although Rwanda has only recorded one M&A deal in the pharmaceutical industry since 2011, the country presents considerable potential in developing the sector. **Rwanda is only one of a handful of SSA countries that outperformed the global median when measuring the quality of scientific research institutions.** Furthermore, the country placed fifth out of 144 countries in relation to the ‘government procurement of advanced technology products’ category in the WEF’s 2014/15 Global Competitiveness Report, with this ranking earning Rwanda the top place in a SSA context. Rwanda performs well in terms of innovation, with the country placing third (following Kenya and South Africa) in SSA in the WEF’s innovation rankings.

Moving west, Ghana also performs relatively well in terms of innovation, placing sixth in SSA in the WEF’s innovation rankings. The life sciences sector has benefitted from the country’s protection of intellectual property rights, as well as the quality of its scientific research institutions. Furthermore, **Ghana has an existing pharmaceutical manufacturing industry,** while the country is also home to several CoEs, which is set to promote further research and development of pharmaceuticals in the country. The Ghanaian government has also partnered with PhytoSearch in an effort to develop a root decoction that is used for aiding feverish patients, with another two genetically modified crop projects underway. Senegal is one of five countries in SSA that outperformed the global median in terms of the quality of its scientific research institutions, with the country boasting **SSA’s fourth most highly regarded research institutions.** The country’s regulatory oversight is also relatively developed, given the existence of a dedicated Science, Technology and Innovation policy.

In a broader African context, 37 African countries have some pharmaceutical production. Significant production capacity is being developed and enriched in Tanzania, Kenya, Uganda, Ethiopia, Ghana, and Nigeria, while Mozambique has recently commissioned an anti-retroviral plant with the help of Brazil. **We consider there to be substantial potential in the life sciences sector, with IMS Health projecting pharmaceutical spending on the continent as a whole to reach some \$31bn by 2017, and potentially reach \$43bn by 2020.** More specifically, countries that have been identified with particularly promising pharmaceutical growth prospects include Nigeria, Mozambique, Angola, Uganda, Tanzania and Botswana.



Appendix

Medical Instrument Density Per 1,000,000 People (2013)						
Country	Magnetic resonance imaging	Computed tomography unit	Gamma camera or nuclear medicine	Linear accelerator	Telecobalt unit	Radiotherapy unit
Angola	0.05	0.42			0.05	0.05
Botswana	0.49	0.99				
Burkina Faso	0.06	0.65	0.06			
Cameroon	0.04	0.63	0.04		0.13	0.13
Cape Verde	2.00	2.00				
Democratic Republic of the Congo (DRC)		0.07	0.01	0.01		0.01
Eritrea	0.16	0.32				
Ethiopia	0.07	0.36	0.01		0.02	0.02
Gabon	1.20	3.59			0.60	0.60
Ghana	0.08	0.15	0.08		0.08	0.08
Ivory Coast	0.15	0.69				
Kenya	0.16	0.25	0.05		0.02	0.02
Madagascar		0.13			0.04	0.04
Malawi	0.06	0.31				
Mali		0.20	0.07	0.07		0.07
Mauritania	0.77	1.54		0.26		0.26
Mauritius	4.82	6.43	2.41	0.80	1.61	2.41
Namibia	0.87	4.78	0.87		0.43	0.43
Nigeria				0.05	0.03	0.07
Senegal	0.14	0.35	0.07		0.07	0.07
Seychelles	10.77	10.77				
Sierra Leone		0.33	0.16			
South Africa	0.23	0.97	0.53	0.40	0.17	0.57
Tanzania	0.04	0.12	0.08		0.06	0.06
The Gambia	0.54	1.08				
Togo	0.15	0.73				
Uganda	0.08	0.45	0.05		0.05	0.05
Zambia	0.07	0.21	0.07	0.07	0.07	0.14
Zimbabwe	0.28	0.42	0.28	0.21	0.21	0.42
Global median	1.95	4.78	1.15	0.81	0.31	1.22
SSA median	0.15	0.44	0.07	0.14	0.07	0.07
North & South America median	2.65	7.03	1.24	1.10	0.48	1.25
Eastern Mediterranean median	1.63	3.82	0.32	0.52	0.27	0.64
Europe median	6.72	13.59	4.75	3.23	0.58	3.50
Western Pacific median	2.39	6.43	0.71	1.41	0.21	1.26

Sources: WHO, NKC Research

Sources of Information

- Africa Innovation Outlook
- African Biosafety Network of Expertise
- African Development Bank
- African Union
- Association of African Universities
- BioMed Central (BMC)
- Business Day
- Chatham House
- IMS Health
- Kenya Pharma Expo
- PharmaAfrica
- New Partnership for Africa's Development
- QS World University Rankings
- SciMago Country & Journal Rankings
- Trade Map
- UNESCO
- United Nations
- University of Stellenbosch
- University World News
- World Bank
- World Economic Forum



Contact details

Africa & South Africa

Seyi Bickersteth

Chairman KPMG Africa

T: +23412805984

E: seyi.bickersteth@ng.kpmg.com

Joubert Krugel

Head of Life Sciences Africa

T: +27825728064

E: joubert.krugel@kpmg.co.za

Anuschka Coovadia

Head of Healthcare Africa

T: +27827192813

E: anuschka.coovadia@kpmg.co.za

Nigeria

Nkata Chuku

Healthcare & Life Sciences lead

T: +23412718957

E: nkata.chuku@ng.kpmg.com

Botswana

Kabelo Moyo

Healthcare & Life Sciences lead

T: +2673912400

E: kabelo.moyo@kpmg.bw

Angola

Fernando Mascarenhas

Partner

T: +351917345975

E: femascarenhas@kpmg.com

Zimbabwe

Garth Burmeister

Partner

T: +2634302600

E: grburmeister@kpmg.com

Ghana

Evans Asare

Healthcare & Life Sciences contact

T: +233501324313

E: Easare@kpmg.com

Zambia

Mafipe Chunga

Healthcare & Life Sciences contact

T: +260965647006

E: mchung@kpmg.com

Mauritius

Ryan Loughins

Healthcare & Life Sciences contact

T: +2304069853

E: rloughins@kpmg.mu

[kpmg.com/social media](http://kpmg.com/social-media)



kpmg.com/app

